SOIL SURVEY OF

Navarro County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experimental Station

Issued December 1974

Major fieldwork for this soil survey was done in the period 1960–67. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Navarro Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Navarro County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all of the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the pasture and hay group and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and pasture and hay groups.

Game managers, sportsmen and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Navarro County will be especially interested in the section "General Soil Map" where broad patterns of soils are described. They will also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover: Rolling Blackland range site on Ferris and Heiden clays, 5 to 15 percent slopes, eroded.

Contents

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SOIL SURVEY OF NAVARRO COUNTY, TEXAS

BY WILLIAM D. MEADE, W. GLEN CHERVENKA, AND JAMES M. GREENWADE, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

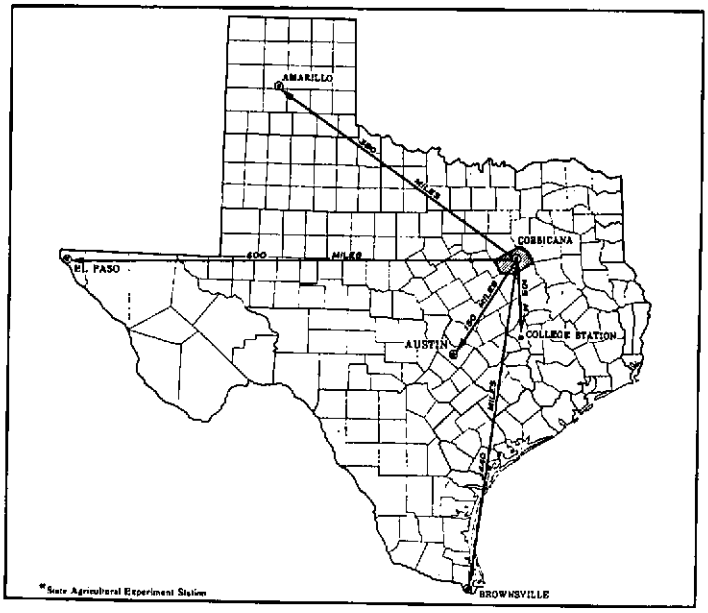

Figure 1.—**Location of Navarro County in Texas.**

NAVARRO COUNTY is in the north-central part of Texas (fig. 1). The total area of the county is 696,320 acres, or 1,088 square miles. This acreage includes water areas, each averaging more than 40 acres in size, which have a total area of about 7,200 acres. The Trinity River is the eastern boundary of the county. Corsicana, the county seat, is in about the center of the county.

From 1930 through 1940, the main farm enterprise was growing cultivated crops. Cotton was the main crop. In more recent years the shift has been to livestock production, mainly beef, and the acreage in cultivated crops has been greatly reduced. Grain sorghum is now the principal crop.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Navarro County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Axtell and Crockett, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Wilson clay loam, 0 to 1 percent slopes, is one of several phases within the Wilson series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such

kinds of mapping units shown on the soil map of Navarro County are soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils. Venus complex, 5 to 15 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Ferris and Heiden clays, 5 to 15 percent slopes, eroded, is an example.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Navarro County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Navarro County are each described in the following pages. The terms for texture used in the title for the associations apply to the surface layer unless otherwise stated. For example, in the title for association 1, the words "moderately fine textured and moderately coarse textured" refer to texture of the surface layer. All major soils in the associations are deep.

1. Crockett-Wilson Association

Moderately fine textured and moderately coarse textured, very slowly permeable, noncalcareous soils

This association consists of nearly level to sloping, very slowly permeable, noncalcareous soils on uplands. These soils formed in material from alkaline marine clay and shale.

This association occupies about 42 percent of the county. Crockett soils make up about 52 percent of the association, Wilson soils about 23 percent, and minor soils the remaining 25 percent (fig. 2).

Crockett soils have a surface layer of brown fine sandy loam about 7 inches thick. The next layer, to a depth of about 68 inches, is very firm clay mottled with shades of gray, red, olive, brown, and yellow. Crockett soils are nearly level to sloping.

Wilson soils have a surface layer of dark-gray clay loam about 3 inches thick. The next layer is very dark gray clay loam about 5 inches thick. Below this is about 20 inches of dark-gray, very firm clay. The next layer, about 20 inches thick, is mottled, very firm clay that is grayish brown in the upper part and light brownish gray in the lower part. The underlying material is firm clay, mottled in shades of olive, yellow, brown, and gray that extends to a depth of 60 inches.

There is no pronounced difference in relief between the Crockett and Wilson soils, but Wilson soils generally are slightly less sloping.

Minor soils in this association are in the Axtell, Gowen, Bonham, Heiden, and Bazette series.

This association is used mostly for pasture. A large acreage was under cultivation at one time.

2. Houston Black-Heiden Association

Fine-textured, very slowly permeable, calcareous soils

This association consists of nearly level to moderately steep soils on uplands. These soils formed in calcareous clay.

This association occupies about 23 percent of the county. Houston Black soils make up about 34 percent of the association, Heiden soils about 31 percent, and minor soils the remaining 35 percent (fig. 3).

Houston Black soils are calcareous clay to a depth of 90 inches. They are very dark gray in the upper part and grade to light olive gray in the lower part. They are predominantly nearly level to gently sloping, but in some areas they are sloping. A small acreage is eroded.

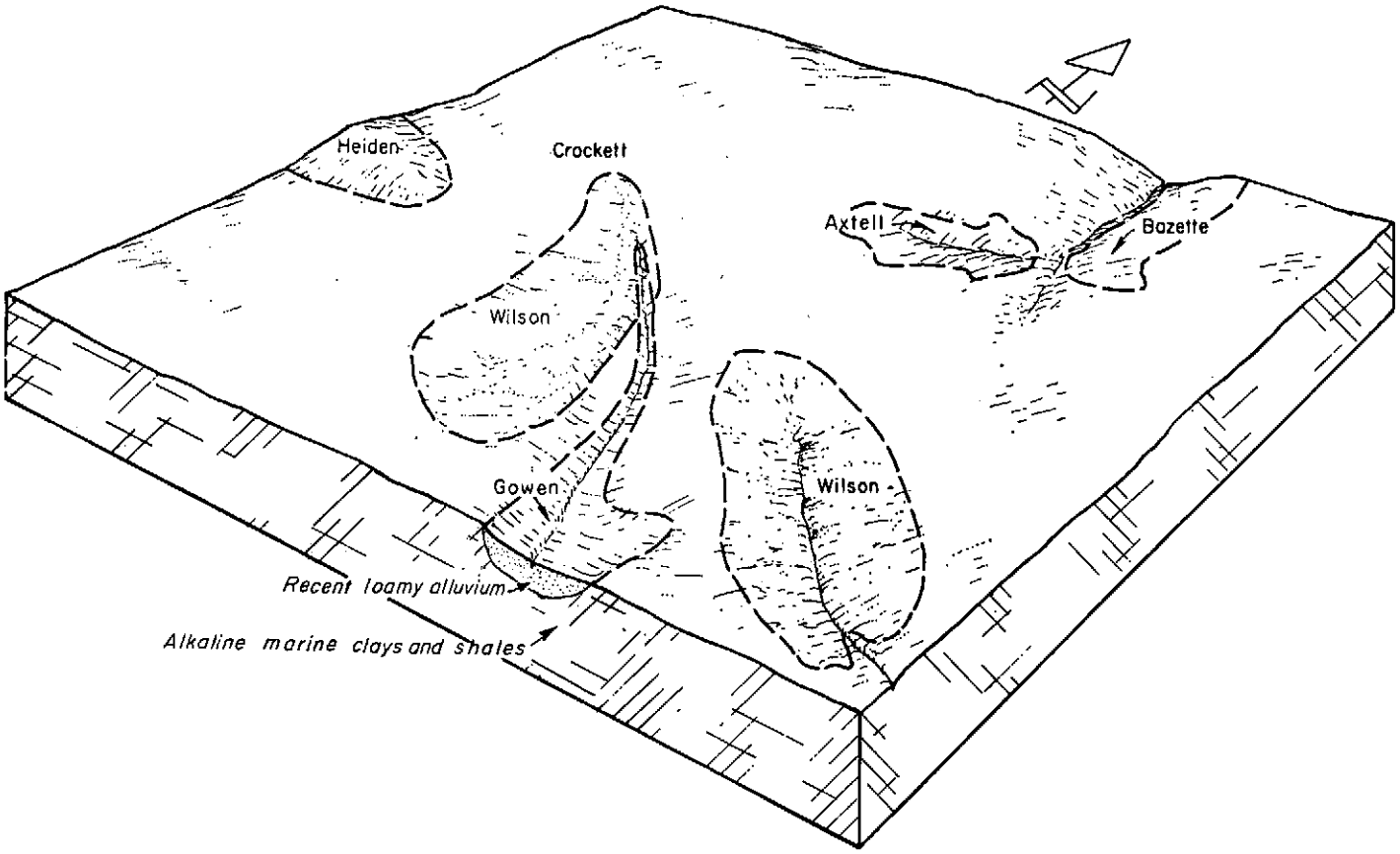

Figure 2.—**Typical pattern of soils in the Crockett-Wilson soil association.**

Heiden soils have a surface layer of dark grayish-brown clay, about 18 inches thick, over mottled olive clay that extends to a depth of more than 80 inches. These soils are gently sloping to moderately steep. About half of the acreage is eroded.

Minor soils in this association are in the Ferris, Lamar, Trinity, and Wilson series.

The areas of this association are cultivated and used for pasture.

3. Trinity-Kaufman Association

Fine- textured, very slowly permeable, calcareous and noncalcareous soils; on bottom land

This association consists of soils on flood plains along the major streams throughout the county. These soils formed in sediment washed from the surrounding uplands. This association occupies about 16 percent of the county. Trinity soils make up 74 percent of the associations, Kaufman soils about 13 percent, and minor soils the remaining 13 percent.

Trinity soils have a surface layer of very dark gray, calcareous clay, about 24 inches thick. The next layer, to a depth of 36 inches, is dark-gray, very firm clay. The underlying material is black, very firm clay.

Kaufman soils are very dark gray clay to a depth of 62 inches.

Minor soils in this association are in the Gowen, Axtell, and Patilo series.

Most of the acreage of this soil association is in pasture, but several areas are cultivated.

4. Wilson-Burleson Association

Fine textured and moderately fine textured, very slowly permeable, noncalcareous soils

This association consists of nearly level to gently sloping soils on uplands. These soils formed in alkaline marine clay and shale.

This association makes up about 13 percent of the county. Wilson soils make up about 32 percent of the association, Burleson soils about 25 percent, and minor soils the remaining 43 percent (fig. 4).

Wilson soils have a surface layer of dark-gray clay loam about 3 inches thick. The next layer is very dark gray clay loam about 5 inches thick. It is underlain by about 20 inches of dark-gray, very firm clay. Below this is about 20 inches of mottled, very firm clay that is grayish brown in the upper part and light brownish gray in the lower part. The underlying material to a depth of 60 inches is firm clay mottled in shades of olive, yellow, brown, and gray. Wilson soils are nearly level to gently sloping.

Burleson soils have a surface layer of very dark gray clay about 30 inches thick. The next layer, to a depth of 45 inches, is dark-gray, very firm clay. The underlying mate-

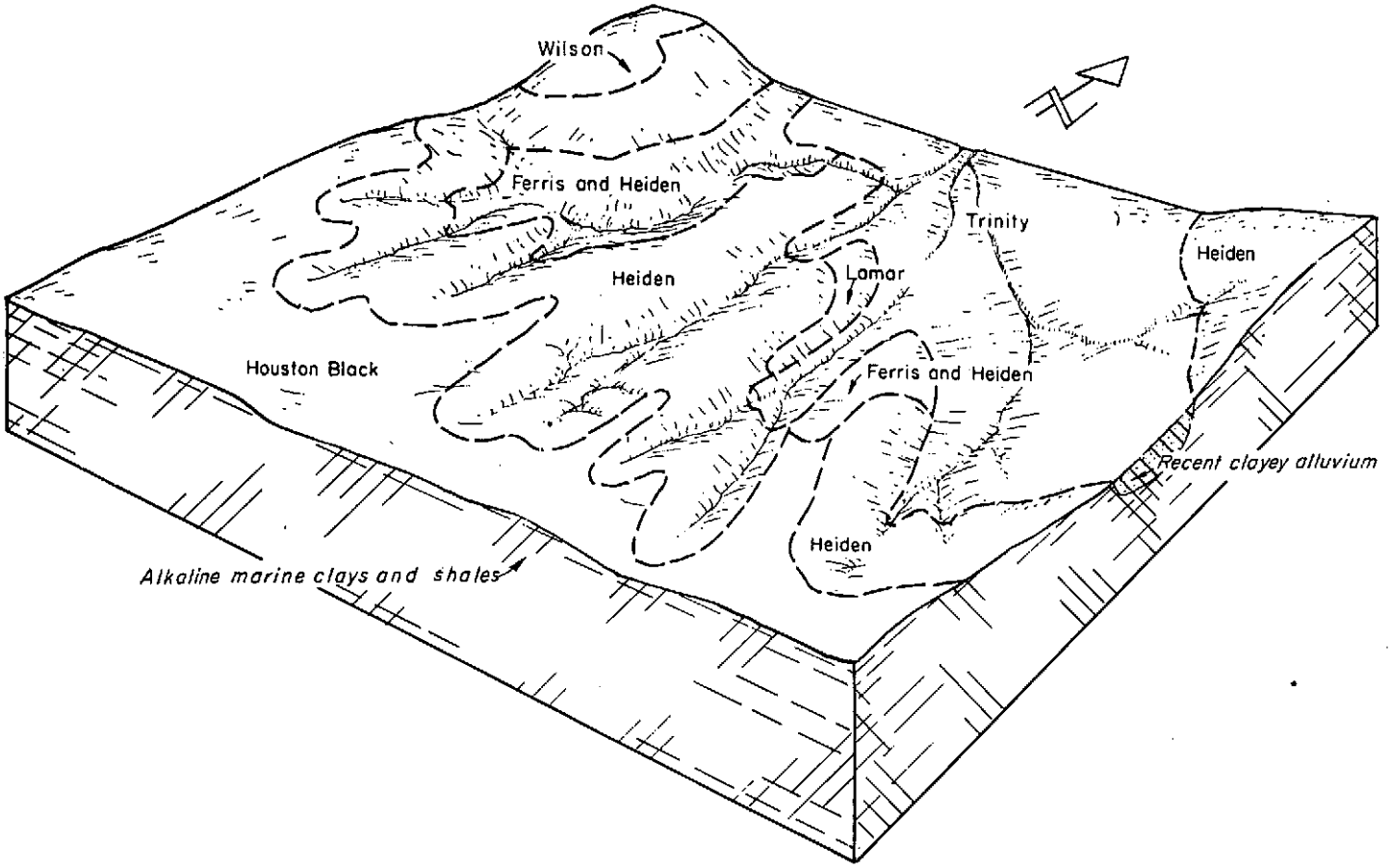

Figure 3.—**Typical pattern of soils in the Houston Black-Heiden association.**

rial, to a depth of 63 inches, is mottled, very firm clay. Burleson soils are nearly level to gently sloping.

Minor soils of this association are in the Crockett, Heiden, Bonham, and Gowen series.

Much of the acreage of the soils in this association is in pasture, but nearly half of it is cultivated.

5. Axtell-Konawa Association

Moderately coarse textured, very slowly permeable and moderately permeable, noncalcareous soils

This association consists of gently sloping to strongly sloping soils on uplands. It occupies about 6 percent of the county. Axtell soils make up about 57 percent of the association, Konawa soils about 8 percent, and minor soils the remaining 35 percent.

Axtell soils have a surface layer of light brownish-gray fine sandy loam about 4 inches thick. The next layer is very pale brown fine sandy loam about 6 inches thick. It overlies mottled, blocky clay that extends to a depth of 82 inches. Axtell soils are gently sloping to strongly sloping.

Konawa soils have a surface layer of light-brown fine sandy loam that is about 10 inches thick and slightly acid. Below is strongly acid sandy clay loam that reaches to a depth of about 45 inches. Konawa soils are gently sloping to sloping.

Minor soils in this association are in the Gowen, Patilo, and Crockett series.

This association is used mainly for pasture. Most areas were cleared and farmed at one time, but only small areas are now cultivated.

Descriptions of the Soils

This section describes the soil series and mapping units in Navarro County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of dry soil.

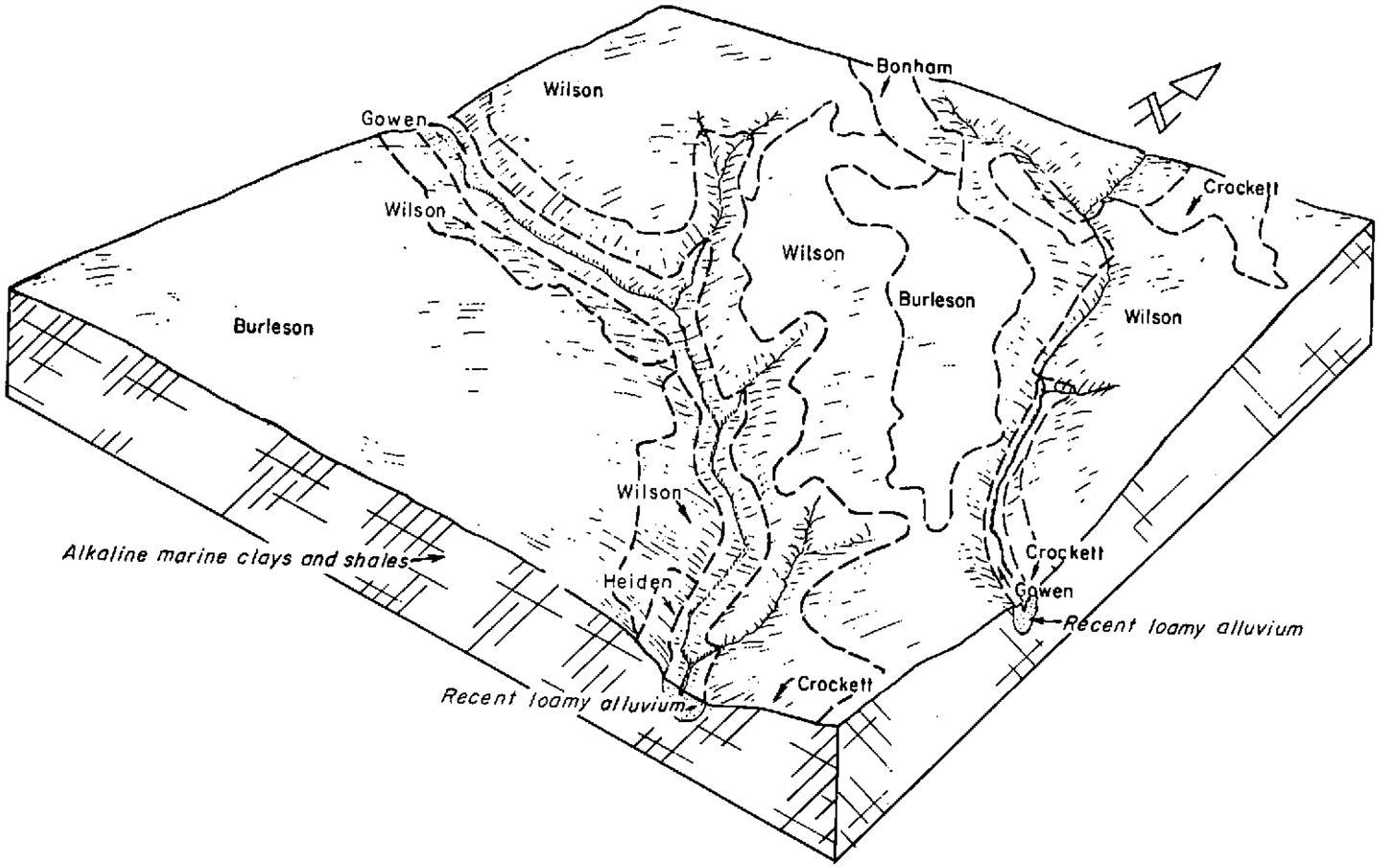

***Figure 4.*—Typical pattern of soils in the Wilson-Burleson association.**

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and pasture and hay group in which the mapping unit has been placed. The page for the description of each capability unit, range site, and pasture and hay group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Some of the terms used in describing soils are defined in the section "How This Survey Was Made" and many can be found in the Glossary at the end of this survey. More detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*).[1]

Altoga Series

The Altoga series consists of deep, well-drained, friable, calcareous soils that formed in marl. The surface is convex and plane. These soils have high available water capacity. Permeability is moderate.

In a representative profile the surface layer is calcareous, dark grayish-brown silty clay about 8 inches thick. The next layer is light olive-brown, friable silty clay in the upper 7 inches and yellow silty clay loam in the lower 30 inches. The underlying material is white, chalky silty clay loam to a depth of about 57 inches.

Representative profile of Altoga silty clay, 2 to 5 percent slopes (30 feet from the fence, east of a county road, 0.3 mile north of Farm Road 1394, and 5.1 miles southwest of Richland from the intersection of Farm Road 1394 and State Highway 14) :

A1—0 to 8 inches, dark grayish-brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, granular structure; hard, friable, sticky and plastic; common roots and worm casts; calcareous; moderately alkaline; clear, smooth boundary.

B21—8 to 15 inches, light olive-brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist, with about 20 percent of light yellowish brown; strong, medium, granular structure; hard, friable, sticky and plastic; common roots and worm casts; few small calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—15 to 45 inches, yellow (2.5Y 7/6) silty clay loam, olive yellow (2.5Y 6/6) moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; the upper 3 or 4 inches and the lower few inches of this horizon are sandy clay loam and the upper 3 or 4 inches appear to be remnants of weakly consolidated sandstone; few fine roots; calcareous; moderately alkaline; gradual, smooth boundary.

[1] Italic numbers in parentheses refer to Literature Cited, p. 67.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Altoga silty clay, 2 to 5 percent slopes	500	0.1	Heiden clay, 5 to 8 percent slopes, eroded	7,300	1.0
Axtell fine sandy loam, 1 to 3 percent slopes	17,200	2.5	Houston Black clay, 0 to 1 percent slopes	5,700	.8
Axtell fine sandy loam, 3 to 5 percent slopes	7,200	1.0	Houston Black clay, 1 to 3 percent slopes	51,200	7.4
Axtell fine sandy loam, 2 to 5 percent slopes, eroded	1,900	.3	Houston Black clay, 3 to 5 percent slopes	4,000	.6
Axtell fine sandy loam, 5 to 12 percent slopes	6,300	.9	Houston Black clay, 2 to 5 percent slopes, eroded	4,300	.6
Bazette silty clay loam, 5 to 20 percent slopes	2,000	.3	Houston Black clay, 5 to 8 percent slopes	800	.1
Bonham loam, 1 to 3 percent slopes	6,100	.9	Kaufman clay	17,300	2.5
Bunyan loam, calcareous variant	700	.1	Kaufman clay, frequently flooded	6,500	.9
Burleson clay, 0 to 1 percent slopes	22,300	3.2	Konawa fine sandy loam, 1 to 3 percent slopes	1,200	.2
Burleson clay, 1 to 3 percent slopes	14,700	2.1	Konawa fine sandy loam, 3 to 8 percent slopes	2,300	.3
Chickasha fine sandy loam, 3 to 8 percent slopes	1,500	.2	Konawa fine sandy loam, 5 to 8 percent slopes, eroded	700	.1
Chickasha soils, 5 to 10 percent slopes, eroded	400	.1	Lamar clay loam, 3 to 8 percent slopes	11,800	1.7
Crockett fine sandy loam, 0 to 1 percent slopes	37,700	5.4	Lamar clay loam, 5 to 12 percent slopes, eroded	2,500	.4
Crockett fine sandy loam, 1 to 3 percent slopes	74,300	10.7	Lufkin fine sandy loam, 0 to 1 percent slopes	1,400	.2
Crockett fine sandy loam, 3 to 5 percent slopes	12,500	1.8	Nimrod loamy fine sand, 0 to 2 percent slopes	900	.1
Crockett fine sandy loam, 5 to 8 percent slopes	5,200	.8	Okemah loam, 0 to 1 percent slopes	6,400	.9
Crockett soils, 2 to 5 percent slopes, eroded	22,900	3.3	Patilo loamy fine sand, 1 to 8 percent slopes	1,200	.2
Crockett soils, 2 to 8 percent slopes, severely eroded	8,500	1.2	Pursley clay loam	3,320	.5
Dougherty loamy fine sand, 0 to 3 percent slopes	700	.1	Pursley clay loam, frequently flooded	1,300	.2
Ellis clay, 3 to 12 percent slopes	5,600	.8	Purves rocky clay, 1 to 5 percent slopes	400	.1
Engle clay loam, 1 to 5 percent slopes	200	(1)	Stidham loamy fine sand, 1 to 5 percent slopes	1,500	.2
Ferris clay, 3 to 8 percent slopes, eroded	9,100	1.3	Tabor fine sandy loam, 0 to 1 percent slopes	3,700	.5
Ferris and Heiden clays, 5 to 15 percent slopes, eroded	10,800	1.6	Trinity clay	41,200	5.9
Ferris and Heiden stony clays, 8 to 15 percent slopes	100	(1)	Trinity clay, frequently flooded	62,000	8.9
Freestone fine sandy loam, 0 to 1 percent slopes	800	.1	Tuckerman loam, ponded	300	(1)
Freestone fine sandy loam, 1 to 3 percent slopes	500	.1	Venus complex, 5 to 15 percent slopes	600	.1
Gowen fine sandy loam	7,000	1.0	Wilson very fine sandy loam, 0 to 1 percent slopes	26,300	3.8
Gowen fine sandy loam, frequently flooded	1,100	.2	Wilson very fine sandy loam, 1 to 3 percent slopes	8,700	1.2
Gowen clay loam	8,600	1.2	Wilson clay loam, 0 to 1 percent slopes	27,200	3.9
Gowen clay loam, frequently flooded	10,200	1.5	Wilson clay loam, 1 to 3 percent slopes	38,500	5.5
Heiden clay, 1 to 3 percent slopes	4,500	.6	Wilson clay loam, 3 to 5 percent slopes	7,200	1.0
Heiden clay, 3 to 5 percent slopes	14,600	2.1	Wilson clay loam, 2 to 5 percent slopes, eroded	2,400	.3
Heiden clay, 3 to 5 percent slopes, eroded	14,400	2.1	Water	7,200	1.0
Heiden clay, 5 to 8 percent slopes	8,900	1.3	Total	696,320	100.0

[1] Less than 0.1 percent.

Cca—45 to 57 inches, white (10YR 8/1) silty clay loam, same color moist, with about 10 percent very pale brown; massive; slightly hard, very friable, slightly sticky and slightly plastic; mostly white chalk and soft lime; lower few inches are very pale brown; calcareous; moderately alkaline.

The A1 horizon ranges from 6 to 9 inches in thickness. It ranges from very dark gray to dark grayish brown and very dark grayish brown. Structure ranges from granular to subangular blocky.

The B2 horizon is 12 to 40 inches in thickness. Colors are in shades of yellow, brown, and olive. The texture ranges from silty clay to silty clay loam, and the clay content ranges from 35 percent to about 45 percent. The structure is angular blocky to granular.

The C horizon ranges from white, gray, yellow, and brown to olive.

Altoga silty clay, 2 to 5 percent slopes (AlC).—This is the only Altoga soil mapped in the county. It is gently sloping and is on broad ridgetops on uplands and in low areas at the heads of drains. The areas are irregular in shape and generally follow the ridgetops or the general contour around the steeper part of the slope. They are about 20 acres in size.

Included with this soil in mapping are areas of Engle, Heiden, and Lamar soils, which make up about 10 percent of any mapped area.

This Altoga soil is used mainly for pasture or as range. A few small areas are cultivated. The hazard of erosion is moderate. Some formerly cultivated areas are slightly eroded and have a few gullies. Capability unit IIIe–4; pasture and hay group 7C; Rolling Blackland range site.

Axtell Series

The Axtell series consists of deep, moderately well drained soils that have clayey lower layers. These soils are gently sloping to strongly sloping and are on uplands. The surface is convex and plane. Axtell soils have moderate available water capacity. Permeability is very slow.

In a representative profile the surface layer is fine sandy loam. It is light brownish gray in the upper 4 inches and very pale brown in the lower 6 inches. The next layer in sequence from the top is: 8 inches of mottled, grayish-brown, yellowish-red, and light olive-brown, very strongly

acid, very firm clay; 16 inches of light olive-brown, strongly acid clay; 12 inches of yellowish-brown, neutral clay; and 36 inches of light yellowish-brown, moderately alkaline clay. The underlying material to a depth of about 88 inches is yellowish-brown, very friable very fine sandy loam.

Representative profile of Axtell fine sandy loam, 1 to 3 percent slopes (in woods 220 feet southwest of a county road, 0.6 mile northeast and 0.3 mile northwest of Goodnight, which is about 4.5 miles southeast of Kerens):

A1—0 to 4 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium, granular structure; slightly hard, friable; few fine roots; few worm casts; slightly acid; abrupt, smooth boundary.

A2—4 to 10 inches, very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak, fine, subangular blocky structure; slightly hard, very friable; few siliceous pebbles ¼ to ½ inch in diameter; few fine roots; very strongly acid; abrupt, wavy boundary.

B21t—10 to 18 inches, mottled, grayish-brown (10YR 5/2), yellowish-red (5YR 4/6), and light olive-brown (2.5Y 5/4) clay; moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; continuous clay films on ped faces; few fine roots; few siliceous pebbles ¼ inch in diameter; very strongly acid; clear, smooth boundary.

B22t—18 to 34 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common, fine, prominent, red and grayish-brown mottles which decrease with depth; weak, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; continuous clay films; few fine roots; few fine iron concretions; strongly acid; clear, smooth boundary.

B23t—34 to 46 inches, yellowish-brown (10YR 5/6) clay, light olive brown (2.5Y 5/4) moist; few, fine, faint, strong-brown mottles; weak, coarse, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few discontinous clay films; few siliceous pebbles ¼ inch to 1½ inches in diameter; few medium iron concretions; neutral; clear, smooth boundary.

B3—46 to 82 inches, light yellowish-brown (2.5Y 6/4) clay, same color moist; few, medium, faint, light brownish-gray, olive-yellow, and light-gray mottles; weak, coarse, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few calcium carbonate concretions; few siliceous pebbles ¼ to ⅛ inch in dimeter; few fine iron concretions; few patchy clay films; moderately alkaline; abrupt, smooth boundary.

IIC—82 to 88 inches, yellowish-brown (10YR 5/4) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; layer of weakly cemented light olive-brown sandstone, ½ inch thick, at upper boundary; neutral.

The A horizon ranges from 2 to 12 inches in thickness. The A1 horizon ranges from light brownish gray to dark grayish brown and pale brown. It ranges from subangular blocky to granular in structure, or it is massive. Reaction is strongly acid to neutral.

The A2 horizon ranges from light gray or brown to pale brown or very pale brown. It is structureless (single grain) or has weak subangular blocky structure. Reaction is neutral to very strongly acid.

The B2t horizon is mottled in shades of gray, red, yellow, brown, and olive. The B21t horizon ranges from strongly acid to very strongly acid in reaction. The B22t horizon ranges from strongly acid to neutral in reaction. The two lower Bt horizons range from medium acid to moderately alkaline.

The C horizon is mottled in shades of gray, white, red, yellow, brown, and olive. It ranges from very fine sandy loam to clay. Reaction is moderately alkaline to very strongly acid.

Axtell fine sandy loam, 1 to 3 percent slopes (AxB).—This gently sloping soil is on broad upland ridgetops. The areas are irregular and average about 50 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Crockett, Freestone, Konawa, Lufkin, and Tabor soils. These included soils make up less than 15 percent of any mapped area.

About 65 percent of the acreage of this soil is used for pasture, about 10 percent is cultivated, and about 25 percent is in native vegetation of trees and an understory of grasses. The hazard of erosion is moderate. Capability unit IIIe–1; pasture and hay group 8A; Tight Sandy Loam range site.

Axtell fine sandy loam, 3 to 5 percent slopes (AxC).—This gently sloping soil is on uplands on narrow watershed divides or on the steeper part of the landscape above drainageways. Natural drains are common throughout the areas and there are a few gullies. The areas are irregular in shape and generally follow the contour of the land. They average about 30 acres in size.

The surface layer is dark grayish-brown fine sandy loam in the upper 3 inches and pale-brown fine sandy loam in the lower 6 inches. The next layer is yellowish-red, very firm clay that has many light olive-brown and brown mottles. It is very strongly acid. The lower part grades to mottled light brownish gray, yellowish brown, and brownish yellow and is moderately alkaline. It extends to a depth of about 65 inches. The underlying material, to a depth of about 80 inches, is light yellowish-brown, firm shaly silty clay that has light brownish-gray and yellow mottles.

Included with this soil in mapping are areas of Crockett, Konawa, and Nimrod soils. These included soils make up about 12 percent of any mapped area.

About 40 percent of the acreage is in native vegetation. About 55 percent was formerly farmed but is now abandoned or in pasture. About 5 percent of the acreage is cultivated. Most areas are protected from erosion by a vegetative cover, and very little erosion has taken place. The soil is subject to severe erosion unless protected. Capability unit IVe–1; pasture and hay group 8A; Tight Sandy Loam range site.

Axtell fine sandy loam, 2 to 5 percent slopes, eroded (AxC2).—This gently sloping soil is on uplands. It occupies the steeper part of the landscape between areas of gently sloping soils above and the soils along natural drains. The areas are irregular in shape and generally follow the contour of the land. They average about 20 acres in size.

The surface layer is brown fine sandy loam about 6 inches thick. The next layer is mottled, dark reddish-brown, weak-red, and brown very firm clay that is very strongly acid in the upper part. It grades to mottled, olive-brown and yellowish-brown, very firm, noncalcareous, mildly alkaline clay that extends to a depth of about 60 inches. The underlying material to a depth of about 80 inches is mottled, white, grayish-brown, and brownish-yellow, firm shaly clay that is noncalcareous and moderately alkaline.

Included in mapping are areas of severely eroded Crockett soils. These included soils make up about 12 percent of any mapped area. Practically all the acreage has been cultivated. Now, only about 10 percent of the acreage is under cultivation. About 70 percent is idle or in pasture.

This soil is subject to sheet and gully erosion. The gullies are shallow and V-shaped and are from 30 to 200 feet apart. Some areas between the gullies are only slightly eroded. Capability unit IVe–1; pasture and hay group 8A; Tight Sandy Loam range site.

Axtell fine sandy loam, 5 to 12 percent slopes (AxE).—This sloping to strongly sloping soil occupies breaks between the more level upland soils above and narrow flood plains along small drainageways. The slopes are mostly convex and plane but are steeper near the natural drains. The areas are irregular in shape and generally follow the contour of the land. The areas average about 30 acres in size.

The surface layer is dark grayish-brown fine sandy loam about 4 inches thick. The next layer is mottled red, reddish-brown, and light brownish-gray very fine clay that is strongly acid in the upper part and very strongly acid in the lower part and is 30 inches thick. The underlying material, to a depth of about 80 inches, is mottled, yellowish-brown, light-gray, and pale-yellow, firm silty clay loam that is very strongly acid in the upper part and grades to mildly alkaline in the lower part.

Included in mapping are areas of Crockett and Konawa soils. These included soils make up about 10 percent of any mapped area.

About 60 percent of the acreage of this soil is in native vegetation and about 40 percent is in pasture. This soil is not suitable for cultivation. Capability unit VIe–1; pasture and hay group 8B; Tight Sandy Loam range site.

Bazette Series

The Bazette series consists of moderately deep, well-drained soils on uplands. These soils are mainly sloping to moderately steep. They have slow permeability and high available water capacity.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 6 inches thick. The next layer, to a depth of about 34 inches, is light olive brown. It is silty clay in the upper part but grades to silty clay loam in the lower part. The underlying material is a light-gray shaly clay that extends to a depth of about 60 inches.

Representative profile of Bazette silty clay loam, 5 to 20 percent slopes (4.25 miles northwest of Kerens on Farm Road 636 to Bazette and 3.15 miles northeast on county road):

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; compound, moderate, very fine, angular blocky structure and moderate, medium, granular; hard, firm, sticky and slightly plastic; common roots and pores; slightly acid; clear, smooth boundary.

B2t—6 to 22 inches, light olive-brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist; few, fine, faint splotches of light yellowish brown; moderate, medium, angular blocky structure that parts to very fine angular blocky; clay films on some ped faces; hard, firm, sticky and plastic; contains few worm casts; common fine roots and pores; slightly acid; gradual, smooth boundary.

B3—22 to 34 inches, light olive-brown (2.5Y 5/6) silty clay loam, olive brown (2.5Y 4/6) moist; weak, fine, blocky structure; hard, firm, sticky and plastic; thin clayey shale fragments in the lower part; slightly acid; gradual, smooth boundary.

C—34 to 60 inches, light-gray (2.5Y 7/2) shaly clay, light brownish gray (2.5Y 6/2) moist; common, medium, distinct, olive-yellow mottles and few, fine, faint, brownish-yellow mottles; stratified or thin bedded with yellowish-brown silty clay loam and shale fragments; massive; very hard, very firm; slightly acid.

The A horizon ranges from 3 to 9 inches in thickness. It is dark grayish brown to brown. Reaction is medium acid to neutral.

The B2t horizon ranges from 9 to 24 inches in thickness. It is light yellowish brown, yellowish brown, light olive brown, or olive yellow. Reaction ranges from medium acid to neutral.

The B3 horizon ranges from 6 to 24 inches in thickness. It is yellowish brown, light olive brown, brownish yellow, or olive yellow. Reaction is medium acid to neutral.

The C horizon has mottles in shades of gray, yellow, brown, and olive. Reaction is medium acid to mildly alkaline.

Bazette silty clay loam, 5 to 20 percent slopes (BaF).—This is the only Bazette soil mapped in the county. It is sloping to moderately steep. The areas are irregular in shape and generally follow the contour of the land. They average about 90 acres in size.

Included with this soil in mapping are areas of Axtell, Crockett, and Ellis soils. These included soils make up approximately 8 percent of any mapped area.

This Bazette soil is not suitable for cultivation. About 60 percent of the acreage is in pasture, and the rest is cleared and used for range. The erosion hazard is severe. Some pebbles and stones in concretions as large as 4 feet in diameter are on the surface and in the profile (fig. 5). Capability unit VIe–2; pasture and hay group 7I; Grayland range site.

Bonham Series

The Bonham series consists of deep, moderately well drained soils. These soils are gently sloping and are in broad upland areas. The soil surfaces are plane to convex. Slopes range up to 3 percent. Permeability is slow, and available water capacity is high.

In a representative profile the surface layer is a very dark grayish-brown loam about 9 inches thick. The next layer in sequence from the top is: about 10 inches of brown, firm clay loam; 16 inches of brown, very firm clay mottled in gray, grayish brown, and yellowish red; and 55 inches of light brownish-gray, very firm clay mottled in shades of gray, brown, yellow, olive, and red.

Representative profile of Bonham loam, 1 to 3 percent slopes (33 feet south of a county road ditch, 0.55 mile east and 1.7 miles north and 0.05 mile east of intersection of Farm Road 633 and State Highway 31 in Powell):

A1—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and medium siliceous pebbles; few worm casts and roots; slightly acid; clear, smooth boundary.

B1—9 to 19 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; common, fine, faint mottles of dark yellowish brown; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few siliceous pebbles up to 1½ inches in diameter; few roots; few worm casts; few iron concretions; medium acid; clear, smooth boundary.

B21t—19 to 35 inches, brown (10YR 5/3) clay; many, fine and medium, distinct mottles of gray (10YR 5/1), grayish brown (10YR 5/2), and yellowish red (5YR 5/6); moderate, medium, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common clay films on ped faces; few fine roots; few fine iron concretions; few siliceous pebbles up to ¼ inch in diameter; slightly acid; gradual, smooth boundary.

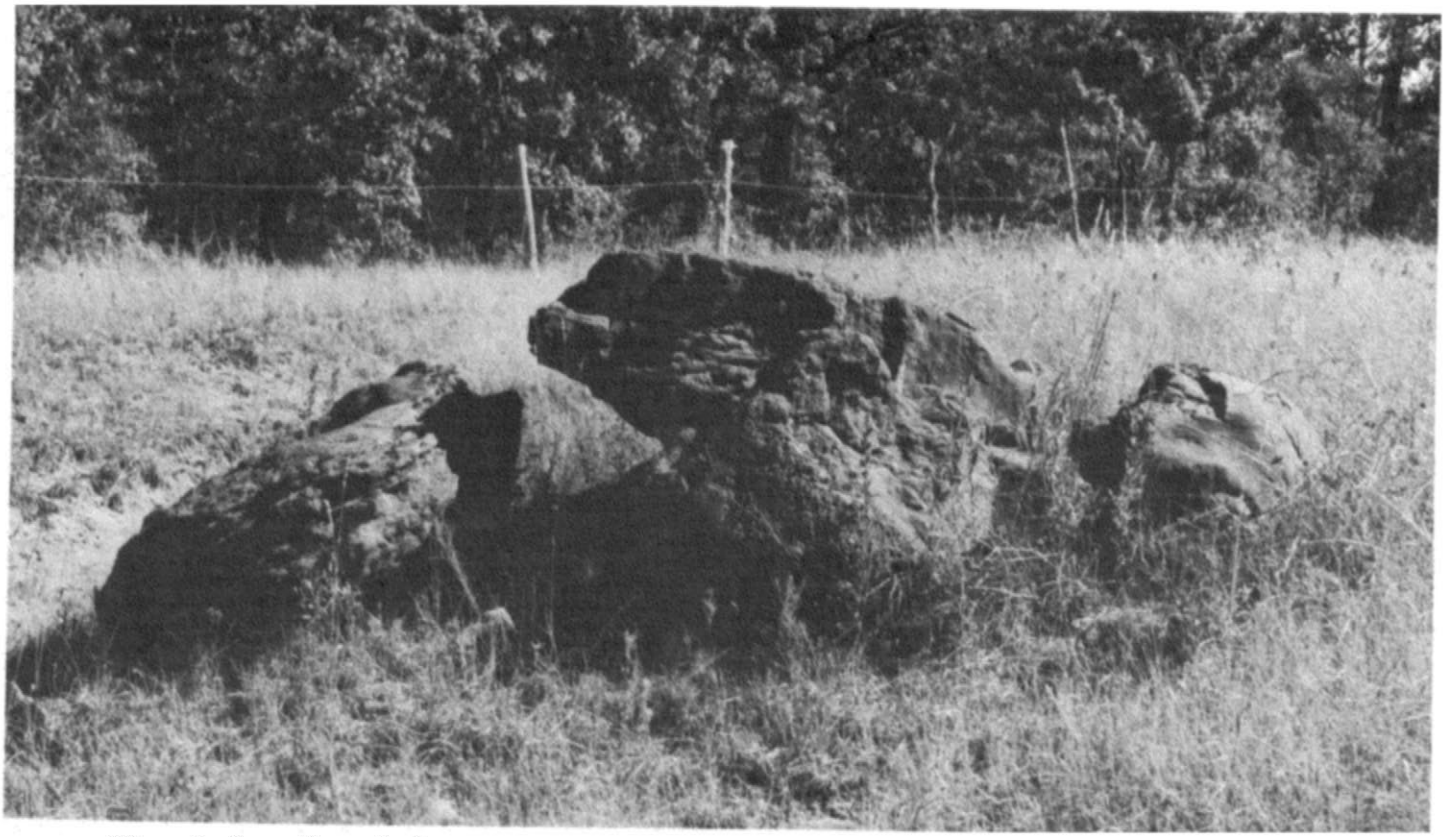

Figure 5.—Concretions of calcareous sandstone and limestone on Bazette silty clay loam, 5 to 20 percent slopes.

B22t—35 to 44 inches, distinctly and coarsely mottled, grayish-brown (10YR 5/2), gray (10YR 5/1), and yellowish-brown (10YR 5/6) clay; common, prominent, yellowish-red (5YR 5/6) mottles; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; clay films on ped faces; few fine roots; few fine iron concretions; few siliceous pebbles up to ¼ inch in diameter; neutral; diffuse, smooth boundary.

B23t—44 to 54 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; many, coarse, distinct mottles of brownish yellow (10YR 6/6) and olive yellow (2.5Y 6/6); weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; clay films on ped faces; few fine roots; few medium iron concretions; slightly acid; diffuse, smooth boundary.

B31t—54 to 65 inches, mottled, light brownish-gray (2.5Y 6/2) and pale-olive (5Y 6/3) clay; weak, blocky structure; extremely hard, very firm, very sticky and very plastic; clay films on ped faces; few fine roots; few siliceous pebbles ½ inch in diameter; medium iron concretions; slightly acid; diffuse, smooth boundary.

B32t—65 to 90 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; few, fine, faint, light-gray and light olive-brown mottles; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few clay films on ped faces; few iron concretions as much as ¼ inch in diameter; few calcium carbonate concretions as much as ¾ inch in diameter; moderately alkaline.

The A horizon ranges from 5 to 12 inches in thickness. It is gray, brown, or very dark grayish brown. Reaction is neutral to medium acid.

The B1 horizon ranges from 5 to 10 inches in thickness. It is mainly dark grayish brown to brown.

The B2t horizon is a mixture of colors in shades of gray, red, yellow, olive, and brown. Reaction is strongly acid to neutral.

Bonham loam, 1 to 3 percent slopes (BmB).—This is the only Bonham soil mapped in the county. It is gently sloping and is on uplands. The areas are irregular and average about 30 acres in size.

Included with this soil in mapping are areas of Crockett and Wilson soils. These included soils make up about 10 percent of any mapped area.

About 60 percent of the acreage of this soil is in pasture, and the rest is cultivated. Much of the acreage now in pasture was formerly cultivated. Capability unit IIe–5; pasture and hay group 7C; Loam range site.

Bunyan Series, Calcareous Variant

These variants from the normal Bunyan soils are well drained and are calcareous. These soils formed in mixed loamy alluvium on flood plains. The soil surface is slightly convex. These soils are subject to flooding once in 2 to 10 years, but the floods are of short duration. The areas are at slightly higher elevation than the rest of the flood plain and are natural levees adjacent to the channel or at the outer part of the flood plain. The soils have high available water capacity. They are moderately permeable.

In a representative profile (fig. 6) the surface layer is calcareous, grayish-brown loam about 7 inches thick. Below the surface layer is light brownish-gray, stratified fine sandy loam, sandy clay loam, clay loam, or silty clay loam to a depth of about 65 inches.

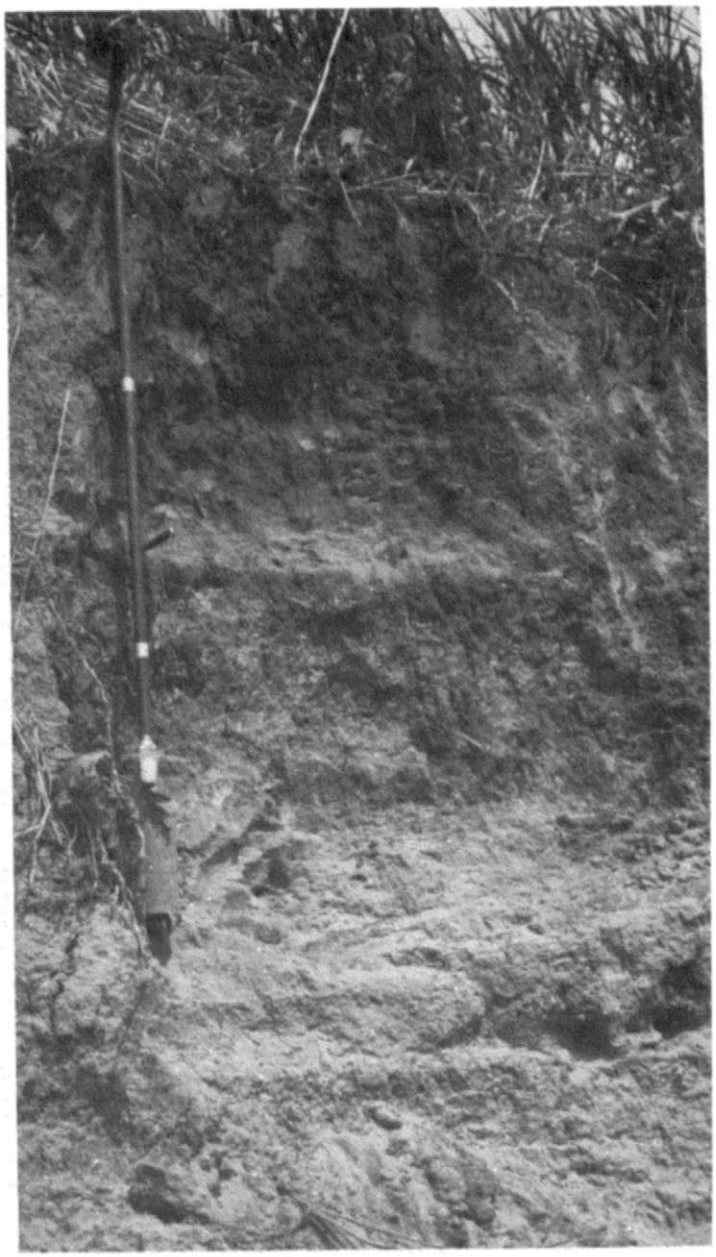

Figure 6.—Profile of Bunyan loam, calcareous variant.

Representative profile of Bunyan loam, calcareous variant (150 feet west of Rush Creek, 0.15 mile north of a county road, and 1.45 miles southwest of Corbet):

Ap—0 to 7 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate, fine, subangular blocky structure; hard, friable; few fine roots; calcareous; moderately alkaline; clear, smooth boundary.

C1—7 to 20 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; few fine roots; calcareous; moderately alkaline; clear, smooth boundary.

C2—20 to 65 inches, light brownish-gray (2.5Y 6/2) clay loam or silty clay loam, dark grayish brown (2.5Y 4/2) moist; stratified, with bedding planes; hard, friable, sticky and plastic; calcareous; moderately alkaline.

The A horizon ranges from 4 to 26 inches in thickness. It is light brownish gray, grayish brown, dark grayish brown, light olive brown, or light yellowish brown. The texture is fine sandy loam, silty clay loam, or loam. Structure is subangular blocky to granular.

The C horizon ranges in color from light gray, light brownish gray, grayish brown, light olive brown, to light yellowish brown. Its texture is fine sandy loam, sandy clay loam, clay loam, or silty clay loam, and in some places clay or loamy fine sand.

Bunyan loam, calcareous variant (Bn).—This is the only variant from the normal Bunyan series mapped in the county. It occupies areas on flood plains along creeks. These areas generally are long and irregular in shape and average 50 acres in size.

Included with this soil in mapping are areas of Gowen, Pursley, and Trinity soils. These included soils make up about 12 percent of any mapped area.

About 65 percent of the acreage of this soil is in cropland and 35 percent is in pasture. Capability unit I–2; pasture and hay group 2A; Bottomland range site.

Burleson Series

The Burleson series consists of deep, moderately well drained, clayey soils. These soils are nearly level to gently sloping and occupy broad upland areas. The soil surface is mainly plane to convex, but in some areas it is slightly concave. Slopes range up to 3 percent. Burleson soils have high available water capacity. They are very slowly permeable, except when the soil is dry and cracked. In places a crust forms on the surface after heavy rains.

In a representative profile the surface layer is very dark gray to dark gray, very firm clay about 45 inches thick. The underlying material to a depth of about 63 inches is gray, very firm clay that has yellowish-brown mottles.

Representative profile of Burleson clay, 0 to 1 percent slopes (100 feet southwest of right-of-way along Farm Road 1393, which is 2 miles southeast of intersection of Farm Road 1393 and State Highway 31 and 1.85 miles east of Powell):

Ap—0 to 8 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak, fine, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; distinct plowpan compacted by tillage at the lower boundary; mildly alkaline; abrupt, smooth boundary.

A11—8 to 30 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few indistinct pressure faces; few very fine iron concretions; mildly alkaline; diffuse, smooth boundary.

A12—30 to 45 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few masses of soft lime; few fine iron concretions; few intersecting slickensides and parallelepipeds; mildly alkaline; diffuse, wavy boundary.

AC—45 to 63 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, fine, faint, yellowish-brown mottles; weak, coarse, blocky structure to massive; extremely hard, very firm, very sticky and very plastic; few masses of soft lime; few fine iron concretions; few intersecting slickensides; mildly alkaline.

The A horizon is very dark gray, dark gray, or black. It ranges from medium acid to moderately alkaline in reaction.

The AC horizon ranges from 8 to 34 inches in thickness. It is gray, dark gray, very dark gray, very dark grayish brown, or grayish brown and has mottles of brown, yellow, yellowish brown, and light olive brown to olive. Reaction ranges from neutral to moderately alkaline.

The C horizon, generally below a depth of about 63 inches, is mottled in shades of gray, yellow, brown, and olive. Reaction is mildly alkaline to moderately alkaline.

Burleson clay, 0 to 1 percent slopes (BuA).—Some areas of this nearly level soil are on broad uplands or on narrow ridgetops. Others are in slightly depressed areas where water stands for a short time. The areas generally are irregular in shape, but in places they are oval to oblong. They average 120 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Okemah, Houston Black, and Wilson soils. These included soils make up about 12 percent of any mapped area.

About 65 percent of the acreage of this soil is cultivated, and the rest is in pasture. Capability unit IIw–2; pasture and hay group 7A; Grayland range site.

Burleson clay, 1 to 3 percent slopes (BuB).—The areas of this gently sloping upland soil are irregular in shape. They average 40 acres in size.

The uppermost 20 inches of this soil is very dark gray, very firm clay. The next layer, to a depth of about 50 inches, is dark-gray, very firm clay. The underlying material to a depth of about 65 inches is mottled, dark grayish-brown, olive-yellow, and light olive-brown, very firm clay.

Included with this soil in mapping are small areas of Heiden, Houston Black, and Wilson soils. These included soils make up about 12 percent of any mapped area.

About 30 percent of the acreage of this soil is cultivated, and the rest is in pasture. The hazard of erosion is moderate. Capability unit IIIe–2; pasture and hay group 7A; Grayland range site.

Chickasha Series

The Chickasha series consists of deep, well-drained upland soils. The soil surface is convex and plane. Slopes are predominantly 5 to 7 percent, but in places they are as much as 10 percent. Chickasha soils have high available water capacity. They are moderately permeable.

In a representative profile (fig. 7) the surface layer is very dark grayish-brown fine sandy loam about 8 inches thick. The next layer in sequence from the top is: 16 inches of sandy clay loam that is brown in the upper part and yellowish brown in the lower part; and 21 inches of a loam that is pale brown in the upper part and light gray in the lower part. Below is weakly cemented sandstone of friable loam that is light gray. It extends to 88 inches.

Representative profile of Chickasha fine sandy loam, 3 to 8 percent slopes (50 feet north of roadbank on Farm Road 2930, which is east of Grange Hall Cemetery, 1.3 miles northwest of the intersections of Farm Road 2930, and Farm Road 1126 in the Cryer Creek community):

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak, medium, granular structure; slightly hard, very friable; few fine roots; slightly acid; clear, smooth boundary.

B21t—8 to 12 inches, brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; many, medium, faint, yellowish-brown mottles and few, fine, distinct, red mottles; moderate, coarse, prismatic structure; very hard, firm, sticky and plastic; few fine roots; clay films on ped faces; medium acid; clear, smooth boundary.

B22t—12 to 24 inches, yellowish-brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few clay films on ped faces; strongly acid; gradual, smooth boundary.

B23t—24 to 38 inches, pale-brown (10YR 6/3) loam, olive brown (2.5Y 4/4) moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; strongly acid; gradual, smooth boundary.

B3—38 to 45 inches, light-gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; few fine roots; medium acid; gradual, wavy boundary.

R—45 to 88 inches, light-gray (10YR 7/2) weakly cemented sandstone of loam texture, light brownish gray (10YR 6/2) moist; common, medium, distinct mottles of brownish yellow and light yellowish brown; massive;

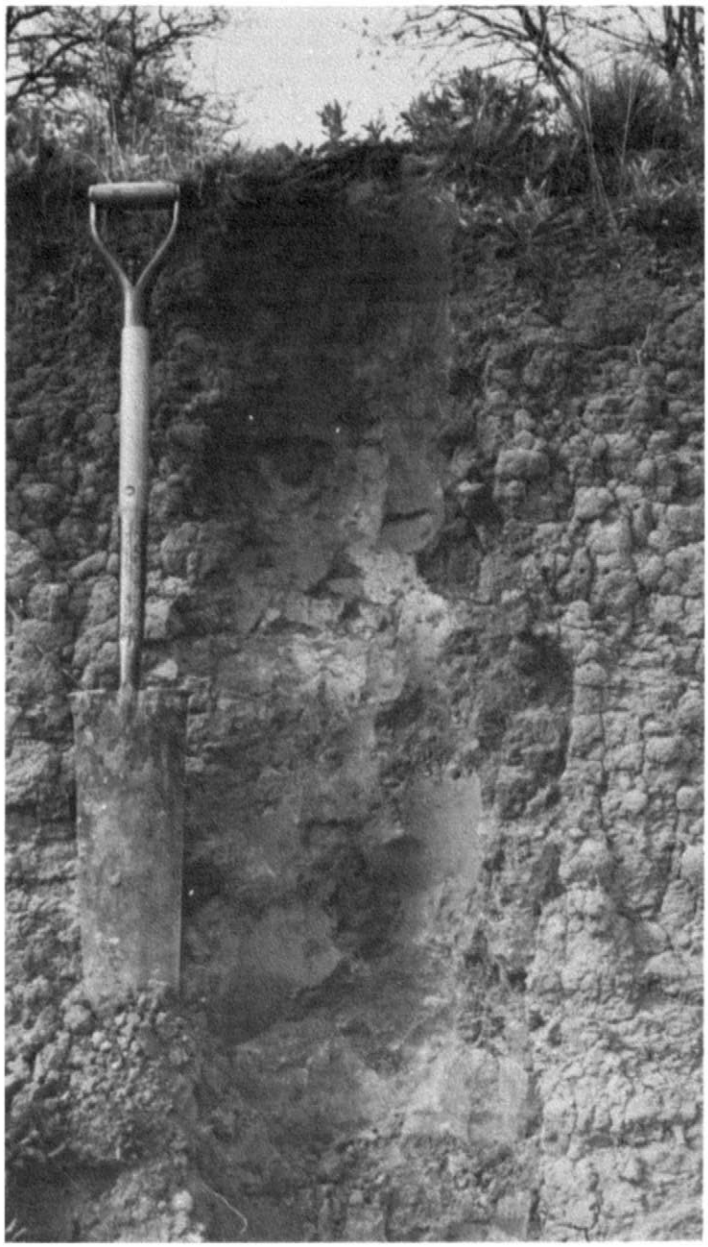

Figure 7.—Profile of Chickasha fine sandy loam, 3 to 8 percent slopes.

hard, friable; few strongly cemented sandstone concretions; few fine calcium carbonate concretions and masses of soft lime; slightly acid in upper part and neutral in lower part.

The A horizon ranges from 7 to 18 inches in thickness. It is dark grayish brown, very dark gray, grayish brown, very dark grayish brown, dark brown, or brown. In places a part of the original A horizon has been lost through erosion, and this horizon is only 3 to 6 inches thick. The material presently in the A horizon is mixed with material formerly in the Bt horizon. It is yellowish brown, olive yellow, light yellowish brown, light olive brown, olive brown, grayish brown, or brown. The texture is fine sandy loam or sandy clay loam.

The B2t horizon ranges from 6 to 30 inches in thickness. It is brown, yellowish brown, pale brown, light brownish gray, dark grayish brown, light olive brown, or olive yellow and has mottles of red, brown, yellowish red, and reddish yellow. Texture ranges from loam to sandy clay loam.

The B3 horizon ranges from 6 to 32 inches in thickness. It is pale brown, light gray, light brownish gray, brownish yellow, or olive yellow and has mottles of reddish yellow, yellowish red, yellow, and light yellowish brown. Reaction is strongly acid to medium acid.

The R layer is light brownish gray, light gray, or olive yellow to yellow. It has mottles of reddish yellow, light yellowish brown, and brownish yellow. Depth to the R layer is 40 to 60 inches.

Chickasha fine sandy loam, 3 to 8 percent slopes (ChD).—This gently sloping to sloping soil is on the sides of drainageways. They are irregular in shape and average 45 acres in size.

This soil has the profile described as representative of the series. Included in mapping are areas of Crockett and Lamar soils. Also included are some eroded spots. These included soils make up about 12 percent of any mapped unit.

This soil is used for pasture and as range. The hazard of erosion is moderate to severe. Capability unit IVe–3; pasture and hay group 8C; Loam range site.

Chickasha soils, 5 to 10 percent slopes, eroded (CkD2).—These sloping to strongly sloping soils are in upland areas adjoining major streams. The areas are on the steeper parts of the landscape between uplands and bottom lands. The areas are irregular in shape and average 25 acres in size.

The surface layer typically is dark grayish-brown fine sandy loam or sandy clay loam about 4 inches thick. The next layer is brown sandy clay loam to a depth of about 20 inches. Below, to a depth of about 43 inches, is pale-brown loam. The underlying material, light-gray loam that has stratified layers of weakly cemented sandstone, extends to a depth of about 80 inches.

Included with these soils in mapping are areas of Crockett, Ferris, and Lamar soils. These included soils make up about 14 percent of any mapped area.

These Chickasha soils are used mainly as range. The hazard of erosion is severe. Capability Unit VIe–2; pasture and hay group 8C; Loam range site.

Crockett Series

The Crockett series consists of deep, moderately well drained soils. The soil surface is convex to plane. Slopes are predominately 1 to 3 percent, but they are as much as 8 percent in places. Permeability is very slow, and available water capacity is high.

In a representative profile the surface layer is brown fine sandy loam about 7 inches thick. The next layer is very firm clay to a depth of about 68 inches. It is mottled red, yellowish red, dark yellowish brown, light olive brown, dark grayish brown, and very dark grayish brown in the upper part. The lower part is mottled in shades of brown, gray, olive, and red. The underlying material is mottled in shades of gray, olive, brown, and yellow. It is clay loam in the upper part and grades to shaly clay and sandy clay loam. It extends to a depth of about 108 inches.

Representative profile of Crockett fine sandy loam, 1 to 3 percent slopes (220 feet northeast of a county road, at a point 0.4 mile east, 1.55 miles southeast, and 0.3 mile southwest of the intersection of U.S. Highway 287 and Farm Road 637 at Eureka):

Ap—0 to 7 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, very friable; few fine roots; few medium and coarse quartz pebbles as much as ¾ inch in length; medium acid; abrupt, wavy boundary.

B21t—7 to 27 inches, mottled, red (2.5YR 4/6), yellowish-red (5YR 4/6), dark yellowish-brown (10YR 4/4), and light olive-brown (25Y 5/4) clay; weak, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few roots; few medium quartz pebbles; few medium iron concretions; few prominent pressure faces and clay films; medium acid; gradual, smooth boundary.

B22t—27 to 45 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; few, fine, distinct mottles of red and dark reddish brown; weak, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few medium quartz pebbles; few fine and medium iron concretions; several prominent pressure faces and clay films; few calcium carbonate concretions starting at a depth of 40 inches; moderately alkaline; gradual, smooth boundary.

B3—45 to 68 inches, mottled, brown (10YR 4/3), pale-brown (10YR 6/3), light-gray (10YR 6/1), light yellowish-brown (10YR 6/4), light olive-brown (2.5Y 5/4), and red (2.5YR 4/6) clay; weak, coarse, blocky structure to massive; extremely hard, very firm, very sticky and very plastic when wet; few calcium carbonate concretions and a few masses of powdery lime; few fine and medium iron concretions; few patchy clay films; calcareous; moderately alkaline; diffuse, wavy boundary.

C1—68 to 92 inches, mottled, light-gray (10YR 6/1), olive-gray (5Y 4/2), olive (5Y 5/4), and brownish-yellow (10YR 6/6) clay loam; massive; hard, friable, sticky and plastic; few fine, soft iron concretions; few calcium carbonate concretions; stratified layers of shaly clay and sandy clay; calcareous; moderate alkaline; clear, wavy boundary.

C2ca—92 to 100 inches, olive (5Y 5/3) shaly clay, same color as above moist; many, coarse, light olive-brown mottles; massive; very hard, firm, sticky and plastic; about 20 percent, by volume, soft masses of lime; calcareous; moderately alkaline; clear, wavy boundary.

C3—100 to 108 inches, light yellowish-brown (2.5Y 6/4) sandy clay loam, light olive brown (2.5Y 5/4) moist; few, fine, faint, light-gray and olive-gray mottles; massive; hard, friable, sticky and plastic; about 10 percent, by volume, masses of soft lime; calcareous; moderately alkaline.

The A horizon ranges from 3 to 15 inches in thickness. It is brown, gray, very dark grayish brown, yellowish brown, dark grayish brown, or light yellowish brown. The texture ranges from fine sandy loam to loam. Reaction is slightly acid to strongly acid.

The B2t horizon is mottled in shades of gray, red, yellow, olive, and brown. Its texture is clay, silty clay, or sandy clay. Reaction is medium acid to moderately alkaline.

The C horizon is mottled in shades of white, gray, brown, yellow, olive, and red. Its texture ranges from loam to clay, shaly silty clay, or clayey shale. Reaction is slightly acid to moderately alkaline.

Crockett fine sandy loam, 0 to 1 percent slopes (CrA).—The areas of this nearly level soil are on broad uplands or on narrow ridgetops throughout the county. The areas are irregular in shape and average about 60 acres in size.

The surface layer of this soil is brown fine sandy loam about 6 inches thick. The next layer, to a depth of about 68 inches, is very firm clay. The upper part is mottled in shades of red, dark yellowish brown, and olive brown. The lower part is mottled in shades of red, light olive brown, and gray. The underlying material is mottled white, gray, yellowish-brown, and olive-yellow, firm clay. It extends to a depth of about 100 inches.

Included with this soil in mapping are areas of Okemah and Wilson soils. These included soils make up about 15 percent of any mapped area.

About 90 percent of the acreage of this soil is in pasture or range, and the rest is cultivated. A large part of the acreage now in pasture or range formerly was cultivated. Capability unit IIIs–1; pasture and hay group 8A; Grayland range site.

Crockett fine sandy loam, 1 to 3 percent slopes (CrB).—This gently sloping soil occupies broad areas on uplands. The areas are irregular in shape and average 65 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Axtell, Bonham, and Wilson soils. These included soils make up about 15 percent of any mapped area.

This Crockett soil is used mainly for pasture; part of the acreage is cultivated. Most of the acreage now in pasture formerly was cultivated. The hazard of erosion is moderate. Capability unit IIIe–1; pasture and hay group 8A; Grayland range site.

Crockett fine sandy loam, 3 to 5 percent slopes (CrC).—Some areas of this gently sloping upland soil are on the steeper slopes near bottom lands and in sloping areas on each side of drainageways. The areas follow the approximate contour of the land. They are irregular in shape and average about 25 acres in size.

The surface layer is dark grayish-brown fine sandy loam about 9 inches thick. The next layer is mottled reddish-brown, brown, and light olive-brown, very firm clay in the upper part and mottled light yellowish-brown and brownish-yellow, firm silty clay in the lower part. It is about 31 inches thick. The underlying material is shaly silty clay that is mottled in shades of brown, yellow, and gray. It extends to a depth of about 100 inches.

Included with this soil in mapping are areas of Axtell, Heiden, and Wilson soils. Also included are some eroded spots. These included soils make up about 12 percent of any mapped area.

This Crockett soil is used mainly for pasture; a small acreage is cultivated. Part of the acreage now in pasture formerly was cultivated. The hazard of erosion is severe. Capability unit IVe–1; pasture and hay group 8A; Grayland range site.

Crockett fine sandy loam, 5 to 8 percent slopes (CrD).—This sloping upland soil occupies steeper slopes between gently sloping areas of higher lying Crockett or Wilson soils and sloping areas on each side of drainageways. The areas are irregular in shape, generally follow the contour of the land, and average about 25 acres in size.

The surface layer is brown fine sandy loam about 6 inches thick. The next layer, mottled in shades of brown and red, is very firm clay in the upper part. The lower part, mottled in shades of brown, gray, and yellow, is firm silty clay. It is about 42 inches in thickness. The underlying material, to a depth of about 100 inches, is loam that is mottled in shades of brown, yellow, and white.

Included with this soil in mapping are spots of Axtell, Ellis, and Heiden soils. These included soils make up about 15 percent of any mapped area.

Most of the acreage of this soil is in pasture; some of the acreage formerly was cultivated. The hazard of erosion is severe. This soil is unsuitable for cultivation. Capability unit VIe–1; pasture and hay group 8B; Grayland range site.

Crockett soils, 2 to 5 percent slopes, eroded (CtC2).—These gently sloping upland soils mainly occupy the steeper part of the landscape between gently sloping uplands and natural drainageways. The areas generally follow the contour of the land and average 20 acres in size.

The surface layer is brown fine sandy loam or loam and is about 4 inches thick. The next layer is mottled, brown and reddish-brown, very firm clay in the upper part and grades to mottled, gray, brown, and yellow, very firm clay in the lower part. It is about 56 inches thick. The underlying material is light olive-gray clay that has mottles in shades of yellowish brown and olive yellow. It extends to a depth of about 100 inches.

Included with these soils in mapping are areas of Heiden and Wilson soils. These included soils make up about 14 percent of any mapped area.

Most of the acreage was formerly cultivated, but large acreages are now in pasture. The soils have been damaged by sheet and gully erosion. The gullies are V-shaped, short, broad, and shallow. Capability unit IVe–5; pasture and hay group 8A; Grayland range site.

Crockett soils, 2 to 8 percent slopes, severely eroded (CtD3).—These gently sloping to sloping soils are on the steeper part of the landscape and on the sides of drainageways. The areas are irregular in shape, generally follow the contour of the land, and average 15 acres in size.

The surface layer typically is brown fine sandy loam or loam about 3 inches thick. The next layer is mottled, brown, dark grayish-brown, and reddish-brown, very firm clay in the upper part. It grades to mottled, light olive-brown, yellow, and gray, firm clay in the lower part. It is about 42 inches thick. The underlying material is very firm clayey shale that is mottled in shades of brown and gray. It extends to a depth of about 100 inches.

Included with these soils in mapping are areas of Ellis and Ferris soils. These included soils make up about 12 percent of any mapped area.

These soils are in pasture. They are severely eroded. Shallow V-shaped gullies, 5 to 30 feet wide, cut into much of the areas. Areas between gullies range from 30 to 100 feet in width. Capability unit VIe–1; pasture and hay group 7I; Grayland range site.

Dougherty Series

The Dougherty series consists of deep, well-drained soils. These soils are nearly level to gently sloping and occupy slightly undulating uplands. The soil surface is slightly

convex and plane. Slopes range from 0 to 3 percent. Internal drainage is medium, permeability is moderate, and available water capacity is low.

In a representative profile the surface layer is loamy fine sand about 24 inches thick. It is pale brown in the upper part and light yellowish brown in the lower part. The next layer, to a depth of about 72 inches, is yellowish-red sandy clay loam. The underlying material to a depth of about 100 inches is reddish-yellow sandy clay loam.

Representative profile of Dougherty loamy fine sand, 0 to 3 percent slopes (west of county road, 80 feet from fence, 0.4 mile north of Finch School, 1.5 miles east, and 2.55 miles north of Farm Road 1129 from its junction with Farm Road 1603 northeast of Chatfield):

A1—0 to 9 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; weak, fine, granular structure to single grain; soft, loose; many roots; slightly acid; clear, wavy boundary.

A2—9 to 24 inches, light yellowish-brown (10YR 6/4) loamy fine sand, brown (7.5YR 4/4) moist; single grain; soft, loose; few roots; few very fine iron concretions; slightly acid; clear, smooth boundary.

B21t—24 to 38 inches, yellowish-red (5YR 5/8) sandy clay loam, darker yellowish red (5YR 4/6) moist; moderate, coarse, prismatic structure breaking to weak, medium subangular blocky; clay films on ped faces; very hard, firm; few very fine iron concretions; slightly acid; gradual, smooth boundary.

B22t—38 to 58 inches, yellowish-red (5YR 5/6) sandy clay loam, darker yellowish red (5YR 4/6) moist; weak, coarse, prismatic structure breaking to weak, coarse, subangular blocky; clay films on ped faces and bridging sand grains; very hard, firm; few, very fine, soft iron concretions; slightly acid; gradual, wavy boundary.

B3—58 to 72 inches, yellowish-red (5YR 5/6) sandy clay loam, darker yellowish red (5YR 4/6) moist; weak, coarse, subangular blocky structure; very hard, firm; few, very fine, soft iron concretions; medium acid; diffuse, wavy boundary.

C1—72 to 100 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; massive; hard, friable; slightly stratified; few, very fine, soft iron concretions; strongly acid; gradual, wavy boundary.

C2—100 to 124 inches, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few to common fine siliceous pebbles; few very fine spots of soft iron concretions; very strongly acid.

The A horizon ranges from 20 to 36 inches in thickness. The A1 horizon is pale brown, brown, or brownish yellow. The A2 horizon is light brown, very pale brown, pale brown, or light yellowish brown. The B2t horizon is 34 to 56 inches in thickness. It is reddish yellow, yellowish red, brown, or strong brown. The B3 horizon is 6 to 23 inches in thickness. It is yellowish red to reddish yellow. The C horizon is loamy fine sand, fine sandy loam, or sandy clay loam.

Dougherty loamy fine sand, 0 to 3 percent slopes (DoB).—This is the only Dougherty soil mapped in the county. This nearly level to gently sloping soil is on uplands. The areas are irregularly shaped and average 145 acres in size.

Included with this soil in mapping are areas of Konawa, Patilo, and Tuckerman soils. These included soils make up about 10 percent of any mapped area.

Nearly all the acreage of this soil is in pasture. All the acreage is cleared, and most of it formerly was cultivated. Capability unit IIs–3; pasture and hay group 9A; Sandy range site.

Ellis Series

The Ellis series consists of moderately deep, clayey soils on uplands. The soil surface is convex to plane. Slopes are complex. They are predominantly 5 to 10 percent but range from about 3 to 12 percent. The soils have low available water capacity.

In a representative profile (fig. 8) the soil is clay to a depth of about 30 inches. The upper part is grayish brown. The lower part is gray, olive, or brown and is mottled in shades of gray, olive, yellow, or brown. The underlying material, to a depth of 36 inches, is mottled shaly clay that grades to shale.

Representative profile of Ellis clay, 3 to 12 percent slopes (4.25 miles northwest of Kerens on Farm Road 636 to Bazette, and 2.2 miles northeast on county road):

A—0 to 4 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; hard surface crust about ⅛ inch thick; moderate, medium, subangular and angular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; neutral; gradual, smooth boundary.

B1—4 to 13 inches, olive (5Y 5/3) clay, darker olive (5Y 4/3) moist; moderate, medium, subangular and angular blocky structure; extremely hard, very firm, sticky and plastic; few roots; few fine and medium, strongly cemented, calcium carbonate concretions; neutral; gradual, smooth boundary.

B2—13 to 23 inches, distinctly and coarsely mottled, olive-yellow (2.5Y 6/6) and gray (10YR 5/1) clay; weak, coarse, subangular blocky structure that breaks to moderate, fine, angular blocky; extremely hard, very firm, sticky and plastic; few fine roots; few small slickensides; few strongly cemented calcium carbonate concretions; mildly alkaline; gradual, smooth boundary.

B3—23 to 30 inches, gray (N 6/0) clay, darker gray (N 5/0) when moist, few, medium, distinct mottles of brownish yellow; weak, medium and fine, subangular and angular blocky structure; extremely hard, very firm, sticky and plastic; few small slickensides; few, fine, strongly cemented, calcium carbonate concretions; mildly alkaline; gradual, smooth boundary.

C—30 to 36 inches, distinctly and coarsely mottled, light olive-gray (5Y 6/2) and yellow (5Y 7/6) shaly clay; massive but natural cleavage of shale is coarse, angular blocky; extremely hard, very firm, sticky and plastic; few fine roots; mildly alkaline; clear, irregular boundary.

R—36 to 66 inches, gray (6/0) shale; distinct, yellow mottles; massive, rock structure; extremely hard, very firm; few fine roots in crevices; mildly alkaline.

The A horizon ranges from 2 to 10 inches in thickness. It is grayish brown, dark grayish brown, yellowish brown, or light olive brown. Structure is blocky to granular.

The B1 and B2 horizons combined range from 6 to 29 inches in thickness. They are light olive brown, yellow, gray, dark grayish brown, olive yellow to olive, and they have few to common mottles in these colors. The B3 horizon ranges from 7 to 14 inches in thickness. It is gray, light olive brown to olive yellow, and has few to common, distinct mottles. The C horizon ranges from 4 to 16 inches in thickness. It is mottled in shades of gray, yellow, brown, and olive.

The R layer is unweathered shale, which can be dug with a spade. It is mottled in shades of gray, yellow, brown, and olive when dry. Indurated iron spheroidal concretions 4 to 12 inches in diameter are common.

Ellis clay, 3 to 12 percent slopes (EIE).—This is the only Ellis soil mapped in the county. The areas of this gently sloping to strongly sloping upland soil are irregular in shape and generally follow the contour of the land. They average about 40 acres in size.

Included with this soil in mapping are areas of Bazette, Burleson, Crockett, Ferris, and Heiden soils. These included soils make up about 12 percent of any mapped area.

This Ellis soil is used for pasture or as range. It is unsuitable for cultivation because of steep slopes and hazard of erosion. Capability unit VIe–1; pasture and hay group 7B; Shaly Hardland range site.

Engle Series

The Engle series consists of moderately deep, well-drained, calcareous, loamy soils over weakly consolidated calcareous sandstone. The soil surfaces are convex and plane. Slopes are predominately 2 to 4 percent, but they range from 1 to 5 percent. Engle soils have low available water capacity. Internal drainage is medium and permeability is moderate.

In a representative profile (fig. 9) the surface layer is very dark grayish-brown clay loam about 12 inches thick. The next layer, about 16 inches thick, also is clay loam. It is grayish brown in the upper part and pale yellow in the lower part. The underlying material to a depth of 32 inches is a pale-yellow, weakly cemented, calcareous sandstone.

Representative profile of Engle clay loam, 1 to 5 percent slopes (350 feet northwest of fence along Farm Road 1394, and 4.95 miles southwest of intersection of Farm Road 1394 and State Highway 14 at Richland):

A1—0 to 12 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate, medium, granular structure; very hard, firm, sticky and plastic; few fine roots; many worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B2—12 to 22 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium and coarse, granular structure; hard, friable, sticky and plastic; few roots; many worm casts of darker material from above and of more yellow soils from below; few, weakly cemented, pale-olive (5Y 6/3), calcareous, sandstone fragments; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—22 to 28 inches, pale-yellow (2.5Y 7/4) clay loam, light yellowish brown (2.5Y 6/4) moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; ½ to 2 percent, by volume, of white powdery lime and few weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

R—28 to 32 inches, pale-yellow (2.5Y 8/4) weakly cemented sandstone; calcareous; moderately alkaline.

The A horizon ranges from 9 to 15 inches in thickness. It is brown, dark grayish brown, or very dark grayish brown.

The B2 horizon ranges from 8 to 11 inches in thickness. It is pale brown, brown, or grayish brown. The B3 horizon ranges from 6 to 8 inches in thickness. It is pale brown or pale yellow to yellow.

The R layer is calcareous sandstone. It is light gray, pale yellow, yellow, or light olive brown.

Engle clay loam, 1 to 5 percent slopes (EnC).—This is the only Engle soil mapped in the county. It is on broad ridgetops and on side slopes. The areas are irregular in shape and average about 20 acres in size.

Figure 8.—**Profile of Ellis clay, 3 to 12 percent slopes (top view) and shale underlying the clay (bottom view). In places rounded ironstone concretions are in the shale.**

Figure 9.—**Profile of Engle clay loam, 1 to 5 percent slopes.**

Included with this soil in mapping are areas of Altoga, Heiden, Lamar, and Purves soils. Also included is a soil in which calcareous sandstone is at a depth of less than 20 inches. These included soils make up about 12 percent of any mapped area.

All of the acreage of this soil is in pasture. The hazard of erosion is moderate. Capability unit IIIe–4; pasture and hay group 7C; Loam range site.

Ferris Series

The Ferris series consists of gently sloping to moderately steep, somewhat excessively drained, calcareous, clayey soils on upland areas. These soils formed in calcareous clays and marls, which are shaly in some places. The soil surfaces are convex to plane. Slopes are dominantly 3 to 10 percent, but they are as much as 15 percent in places. Some areas have microrelief of narrow ridges and valleys that extend up and down the slope. Infiltration is rapid if the soils are dry and cracked and very slow if the soils are wet. Permeability is very slow, and available water capacity is high.

In a representative profile the surface layer is olive, very firm clay about 8 inches thick. Below the surface layer is pale-olive, very firm clay that extends to a depth of about 40 inches. It has faint mottles of brownish yellow. The underlying material is pale-olive and yellow very firm shaly clay that extends to a depth of about 66 inches. It has coarse, prominent mottles.

Representative profile of Ferris clay, 3 to 8 percent slopes, eroded (190 feet east of a county road from a point 3.3 miles north of its intersection with State Highway 22 at Blooming Grove, about 15 miles west of Corsicana):

Ap—0 to 8 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; weak, medium and fine, angular blocky structure, extremely hard, very firm, very sticky and very plastic; surface has mulch, about ½ inch thick, of fine, extremely hard, discrete aggregates; few, fine, strongly cemented, calcium carbonate concretions; few fine grass roots; calcareous; moderately alkaline; gradual, smooth boundary.

AC—8 to 40 inches, pale-olive (5Y 6/3) clay, olive (5Y 5/3) moist; faint mottles of brownish yellow; moderate, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic,; common; coarse, intersecting slickensides at a depth of 24 inches; parallelepipeds have long axes titlted up to 45° from the horizontal; pressure faces are shiny; vertical cracks 1 to 5 cm. wide and 18 inches apart extend to a depth of 40 inches; few, fine, strongly cemented calcium carbonate concretions and few powdery masses of calcium carbonate; few roots; calcareous; moderately alkaline; diffuse, wavy boundary.

C—40 to 66 inches, prominently and coarsely mottled, pale-olive (5YR 6/3) and yellow (2.5Y 7/8) shaly clay; weak, coarse, angular blocky structure mixed with coarse, blocky, shale fragments; extremely hard, very firm; few coarse slickensides; few fine masses and concretions of calcium carbonate; few roots between blocks of rock structure; calcareous; moderately alkaline.

The A horizon ranges from 3 to 22 inches in thickness. It is dark gray, very dark gray, dark olive gray, olive, or pale olive. The AC horizon ranges from 5 to 46 inches in thickness. It is mottled in shades of gray, yellow, brown, and olive. The C horizon is mottled in shades of gray, yellow, brown, and olive. It is clay, shaly clay, or silty clay.

Ferris clay, 3 to 8 percent slopes, eroded (FeD2).—This gently sloping to sloping soil is on ridgetops and on side slopes above bottom land. The areas are irregular in shape, and they average about 30 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Crockett, Heiden, Houston Black, and Lamar soils. These included soils make up about 10 percent of any mapped area.

Most of the acreage of this soil formerly was cultivated, and about 10 percent is still farmed. The rest of the acreage is used for pasture or as range. This soil has been damaged by sheet and gully erosion. Broad shallow gullies 10 to 50 feet wide and 10 to 50 feet apart are common. Capability unit IVe–2; pasture and hay group 7B; Rolling Blackland range site.

Ferris and Heiden clays, 5 to 15 percent slopes, eroded (FhE2).—The major soils in this undifferentiated unit are Ferris soils (67 percent) and Heiden soils (28 percent). These sloping to moderately steep soils are irregular in shape; they follow the contour of steep slopes adjacent to large drainageways. The areas average 30 acres in size. Ferris soils occupy ridgetops and the upper parts of slopes.

Heiden soils occupy the lower parts of slopes and the upper parts of less steep areas. Some areas consist entirely of Ferris soils, some areas consist entirely of Heiden soils, and some areas are a mixture of both soils.

Ferris soils have a surface layer of calcareous, olive, firm clay about 6 inches thick. This layer overlies a layer of pale-olive, firm clay that has olive and olive-brown mottles. This layer is about 16 inches thick. The underlying material is pale-yellow clayey shale that has yellowish-brown mottles to a depth of about 60 inches. Heiden soils have a surface layer of very dark gray, very firm clay, about 13 inches thick, that grades to olive-gray, very firm clay about 37 inches thick. The underlying material is mottled, olive-gray and light olive-brown shaly clay to about a depth of 80 inches.

Included with these soils in mapping are areas of Lamar soils. These included soils make up about 5 percent of any mapped area.

The soils in this unit are suitable for pasture or range. Much of the surface layer has been lost through erosion, and gullies 10 to 50 feet wide, 1 to 5 feet deep, and 50 to 200 feet apart cut through the areas. A few of these gullies are uncrossable with farm machinery. Some areas of Heiden soils are only slightly eroded. Capability unit VIe–2; pasture and hayland group 7B; Rolling Blackland range site.

Ferris and Heiden stony clays, 8 to 15 percent slopes (FlE).—This undifferentiated unit is 46 percent Ferris soils, 40 percent Heiden soils, and 14 percent less extensive soils. These soils are sloping to moderately steep. Narrow limestone ledges originally exposed at the top of steep areas are still present in a few places but most of them have been removed for road material. Below these ledges many rock outcrops and stone or boulders, 4 to 5 feet in diameter, are scattered on and through the soil. Ferris soils occupy the more convex part of slopes. The areas of the soils in this unit follow the contour of steep slopes along the landscape, and they average 45 acres in size.

Ferris soils have a surface layer of dark olive-gray, firm clay about 6 inches thick. The next layer is light olive-brown clay, about 32 inches thick, that contains dark grayish-brown mottles. The underlying material is mottled light yellowish-brown and gray, firm silty clay to shaly clay. Heiden soils have a surface layer of very dark gray, very firm clay, about 20 inches thick, that grades to dark grayish-brown, very firm clay. The next layer is dark-grayish-brown, very firm clay that has light olive-brown mottles. It is about 13 inches thick. The underlying material, to a depth of about 80 inches, is light olive-brown, olive-brown, and light yellowish-brown, very firm calcareous clay or shaly clay.

Included with this soil in mapping are areas of Houston Black clay. This included soil makes up about 14 percent of any mapped area.

Ferris and Heiden stony clays are suited to pasture and to range. The hazard of erosion is severe because of steepness of slopes. Capability unit VIe–2; pasture and hay group 7B; Rolling Blackland range site.

Freestone Series

The Freestone series consists of moderately well drained to somewhat poorly drained upland soils. These soils are nearly level to gently sloping and are on uplands. The soil surface is plane to convex. Slopes range from 0 to 3 percent. Permeability is slow, and available water capacity is high.

In a representative profile the surface layer is fine sandy loam about 18 inches thick. The upper part is light brownish gray, and the lower part is light gray. The next layer, to a depth of 66 inches, is dominantly yellowish brown. In the upper part it is sandy clay loam and has grayish-brown and red mottles. In the lower part it is clay loam that grades to sandy clay and is mottled in shades of gray, brown, yellow, and red. Between depths of 66 and 88 inches is light gray and white, moderately alkaline sandy clay and sandy clay loam.

Representative profile of Freestone fine sandy loam, 0 to 1 percent slopes (southeast of county road, 200 feet from fence, 0.7 mile northeast of Kerens City Lake dam, 3 miles east of Kerens):

A1—0 to 9 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, subangular blocky structure; slightly hard, very friable; few fine roots; slightly acid; clear, smooth boundary.

A2—9 to 18 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 4/3) moist; single grain; slightly hard, very friable; few fine roots; few specks of iron concretions; medium acid; clear, smooth boundary.

B1t—18 to 25 inches, yellowish-brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; common, medium, faint, grayish-brown mottles and few, fine, faint, red mottles; weak, coarse, prismatic structure; hard, friable, slightly sticky and plastic; few clay films bridging sand grains; few fine roots; few very fine specks of iron concretions; very strongly acid; gradual, smooth boundary.

B21t—25 to 36 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; common, medium, grayish-brown and light yellowish-brown mottles; moderate, medium, prismatic to blocky structure; extremely hard, very firm, sticky and plastic; clay films on ped faces; few very fine specks of iron concretions; medium acid; gradual, smooth boundary.

B22t—36 to 66 inches, mottled, yellowish-brown (10YR 5/4), red (2.5YR 4/6), pale-brown (10YR 6/3), and light brownish-gray (10YR 6/2) clay loam; weak, coarse, blocky structure; extremely hard, very firm, sticky and very plastic; clay films on ped faces; few fine roots; few very fine iron concretions; neutral; diffuse, smooth boundary.

B23t—66 to 78 inches, light-gray (2.5Y 7/2) sandy clay, light brownish gray (2.5Y 6/2) moist; common, medium, distinct brownish-yellow mottles; weak, coarse, blocky structure; extremely hard, very firm, sticky and very plastic; few clay films in ped faces and bridging sand grains; few fine roots; few weakly cemented iron concretions and some masses of soft lime; few, white, noncalcareous soft masses and concretions; moderately alkaline; diffuse, wavy boundary.

B3—78 to 88 inches, white (2.5Y 8/2) sandy clay loam, light gray (2.5Y 7/2) moist; weak, coarse, blocky structure to massive; very hard, firm sticky and plastic; very few clay films on ped faces and bridging sand grains; few specks of weakly cemented iron concretions; few fine siliceous pebbles; moderately alkaline.

The A horizon ranges from 6 to 20 inches in thickness. It is very pale brown, light gray, or light brownish gray. Reaction is medium acid to slightly acid. The A2 is light gray or very pale brown. Reaction ranges from strongly acid to slightly acid.

The B1t horizon ranges from 3 to 10 inches in thickness. It is reddish yellow, brown, yellowish brown, or brownish yellow and is mottled in shades of brown, red, and light brownish gray. Reaction is medium acid to very strongly acid. The B2t horizon ranges from 26 to 53 inches in thickness. It is mottled in shades of red, yellow, brown, and gray. The texture is clay,

sandy clay, or clay loam. The B3 horizon is mottled in shades of gray, white, red, yellow, and brown. The C horizon is mottled in shades of gray, white, yellow, and brown.

Freestone fine sandy loam, 0 to 1 percent slopes (FrA).—This nearly level soil is on upland areas. The areas are irregular in shape and average about 35 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Tabor, Lufkin, and Nimrod soils. These included soils make up about 12 percent of any mapped area.

About 97 percent of the acreage of this soil is in pasture, and the rest is farmed. Capability unit I–3; pasture and hay group 8C; Sandy Loam range site.

Freestone fine sandy loam, 1 to 3 percent slopes (FrB).—This gently sloping soil is on upland areas. The areas are irregular in shape and average 30 acres in size. Natural drains are common.

The surface layer is light brownish-gray fine sandy loam about 7 inches thick. The next layer is light-gray fine sandy loam about 5 inches thick. The next lower layer is brown sandy clay loam about 6 inches thick. Below this layer is mottled, yellowish-brown, dark-red, and light-gray clay loam that extends to a depth of about 65 inches. The underlying material is red and light-gray sandy clay loam that extends to a depth of about 60 inches. It has brownish-yellow mottles.

Included with this soil in mapping are areas of Axtell, Konawa, and Nimrod soils. These included soils make up 12 percent of any mapped area.

About 90 percent of the acreage of this soil is in pasture, and the rest is cultivated. The hazard of erosion is moderate. Capability unit IIe–3; pasture and hay group 8C; Sandy Loam range site.

Gowen Series

The Gowen series consists of deep, well-drained soils. These nearly level soils are on flood plains of small streams and along the outer edges of larger streams. The soil surface is plane and slightly convex to concave in small areas. Permeability is moderate, and available water capacity is high.

In a representative profile the surface layer is dark-gray, firm clay loam in the upper 12 inches and dark grayish-brown clay loam to a depth of 48 inches. The underlying material to a depth of about 62 inches is light brownish-gray, stratified loam.

Representative profile of Gowen clay loam, frequently flooded (northwest of county road, 100 feet from fence, and 150 feet northeast of bridge on Rush Creek, 2.1 miles west of Kerens on Highway 31, then 0.2 mile southeast and 0.2 mile southwest to bridge):

A11—0 to 12 inches, dark-gray (10YR 4/1) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few worm casts and pores; some peds with slick surfaces; medium acid; clear, smooth boundary.

A12—12 to 30 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few very fine, soft iron concretions; slightly acid; gradual, smooth boundary.

A13—30 to 48 inches, dark grayish-brown (10YR 4/2) clay loam to loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; medium acid; gradual, smooth boundary.

C—48 to 62 inches, light brownish-gray (10YR 6/2) loam, dark grayish-brown (10YR 4/2) moist; common, fine, faint, mottles of pale brown; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; few bedding planes that contains thin strata of sandy loam; slightly acid.

The A horizon ranges from 20 to more than 60 inches in thickness. Texture ranges from fine sandy loam to clay loam. This horizon is grayish-brown, dark gray, very dark gray, very dark grayish brown, or brown.

The C horizon is grayish brown, light gray, very dark brown, or very pale brown. It has common mottles of brown, brownish yellow, and yellowish brown. Texture ranges from loamy fine sand to clay loam that contains thin strata of clay.

Gowen fine sandy loam (Gn).—Some areas of this soil are on bottom lands or on flood plains of major streams. Other areas occupy the entire flood plain along minor streams. The areas are irregular in shape, are rounded to long and narrow, and average 45 acres in size. Most of this soil is subject to flooding about once in every 4 to 10 years, but some areas are never flooded, because they are protected by flood-prevention structures and levees. Shallow scour channels have been cut in a few areas.

The surface layer is grayish-brown fine sandy loam about 10 inches thick. Below the surface layer, to a depth of about 40 inches, is stratified dark-grayish brown and dark-gray clay loam. The underlying sediment, to a depth of about 60 inches, is loam that contains thin strata of clay.

Included with this soil in mapping are areas of Gowen clay loam. Also included are areas of Kaufman and Trinity soils. These included soils make up about 14 percent of any mapped area.

About 60 percent of the acreage of this soil is in pasture, and the rest is cultivated. Capability unit I–2; pasture and hay group 1C; Bottomland range site.

Gowen fine sandy loam, frequently flooded (Go).—This soil occupies flood plains of streams. The areas are long and narrow and follow the contour of the flood plain. They average 40 acres in size. This soil is subject to flooding at least once every 2 to 3 years during the growing season. Numerous short, shallow scour channels cut in most areas, and the relief is slightly undulating.

The surface layer is grayish-brown fine sandy loam about 10 inches thick. The next layer to a depth of about 45 inches is dark grayish-brown clay loam. The underlying sediment is grayish-brown loamy material to a depth of about 60 inches.

Included with this soil in mapping are areas of Gowen clay loam and areas of Kaufman and Trinity soils. These included soils make up about 12 percent of any mapped area.

All the acreage of this soil is in pasture. Because of frequent and irregular flooding, this soil is not suited to crops. Capability unit Vw–1; pasture and hay group 1C; Bottomland range site.

Gowen clay loam (Gw).—This soil occupies long, narrow, irregularly shaped areas on bottom lands. The areas average 50 acres in size. This soil formed in alluvium of mixed origin. It is subject to flooding about once every 4 to 10 years, but some areas are never flooded because they are protected by flood-prevention structures and levees. A few scour channels have been cut in areas of this soil.

The surface layer is very dark grayish-brown clay loam

about 10 inches thick. The next layer, to a depth of about 40 inches, is very dark gray and very dark grayish-brown clay loam or sandy clay loam. The underlying sediment to a depth of about 60 inches is very dark brown.

Included with this soil in mapping are areas of Gowen fine sandy loam and areas of Kaufman and Trinity soils. These included soils make up about 12 percent of any mapped area.

About 40 percent of the acreage of this soil is cultivated, and the rest is in pasture. Capability unit I–1; pasture and hay group 1C; Bottomland range site.

Gowen clay loam, frequently flooded (Gy).—This soil occupies narrow flood plains that drain mixed upland soils. The areas are irregular in shape and average 75 acres in size. This soil floods at least once every 2 to 3 years during the growing season. A few short, shallow scour channels occur in some areas.

This soil has the profile described as representative of the series. Included in mapping are areas of Bunyan, calcareous variant, and areas of Kaufman, Pursley, and Trinity soils. These included soils make up about 12 percent of any mapped area.

About half of the acreage of this soil is cleared and is in pasture. Because this soil is subject to frequent and irregular flooding, it is not suitable for cultivation. In some years floodwater stands in some low areas for several days or weeks. Capability unit Vw–1; pasture and hay group 1C; Bottomland range site.

Heiden Series

The Heiden series consists of deep, well-drained, calcareous clay soils that formed in weakly consolidated clay and clayey shale. These gently sloping to moderately steep soils are on uplands. The soil surface is plane to convex. Internal drainage is slow. Infiltration is rapid if the soils are dry and cracked, but very slow if the soils are wet. Permeability is very slow, and available water capacity is high.

In a representative profile the surface layer is dark grayish-brown, very firm, calcareous clay about 18 inches thick. The next layer is olive, very firm clay about 26 inches thick. It has light olive-brown and olive-yellow mottles. The underlying material, to a depth of about 88 inches, is mottled, light olive-brown, brownish-yellow, and light olive-gray, firm shaly clay that is calcareous.

Representative profile of Heiden clay, 3 to 5 percent slopes (northeast of a county road, 50 feet from fence, and 3.35 miles north on winding road of State Highway 22 at Blooming Grove):

Ap—0 to 6 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, granular structure; very hard, very firm, very sticky and very plastic; few fine roots; several calcium carbonate concretions; many worm casts; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 18 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, medium and fine, angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; many worm casts; several calcium carbonate concretions as much as 1 inch in diameter; few slickensides and parallelepipeds in lower part; shiny ped faces; calcareous; moderately alkaline; gradual, wavy boundary.

AC—18 to 44 inches, olive (5Y 5/3) clay, darker olive (5Y 4/3) moist; many, medium, faint, light olive-brown and olive-yellow mottles; moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; intersecting slickensides as much as 1 foot across; parallelepipeds, 1½ inches long, tilted more than 30 degrees from the horizontal; partly sealed cracks about 15 inches apart; few roots; common calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

C—44 to 88 inches, prominently and coarsely mottled, light olive-brown (2.5Y 5/4), brownish-yellow (10YR 6/6), and light olive-gray (5Y 6/2) shaly clay; rock structure; very hard, firm, very sticky and very plastic; few masses of powdery lime; few fine roots; few calcium carbonate concretions; calcareous; moderately alkaline.

The A horizon ranges from 4 inches to 38 inches in thickness. It is dark gray, very dark gray, very dark brown, very dark grayish brown, dark grayish brown, olive gray, or dark olive gray. The AC horizon is 8 to 37 inches in thickness. It is mottled in shades of gray, yellow, brown, olive, and black. The C horizon is mottled in shades of gray, yellow, brown, and olive.

Heiden clay, 1 to 3 percent slopes (HaB).—This gently sloping upland soil is on ridgetops, on long side slopes, and on foot slopes below steeper Heiden soils. The areas are irregular in shape and average about 20 acres in size.

The surface layer is very dark grayish-brown, very firm clay about 28 inches thick. Below the surface layer is dark grayish-brown clay about 14 inches thick. It has light olive-brown mottles. The underlying material is pale-olive, very firm clay to a depth of about 80 inches.

Included with this soil in mapping are areas of Ferris, Houston Black, and Wilson soils. These included soils make up about 12 percent of any mapped area.

About 70 percent of the acreage of this soil is in pasture, and the rest is cultivated. A high percentage of the acreage now in pasture formerly was cultivated. The hazard of erosion is moderate. Some areas are slightly eroded and have a few gullies. Capability unit IIe–1; pasture and hay group 7A; Rolling Blackland range site.

Heiden clay, 3 to 5 percent slopes (HaC).—This gently sloping upland soil is on breaks, on the steeper parts of the landscape, and on narrow ridgetops. The areas are irregular in shape and generally follow the contour of the land. They average 25 acres in size. A few short, shallow gullies occur in some areas.

This soil has the profile described as representative of the series. Included in mapping are areas of Ferris, Houston Black, and Wilson soils. Also included is a soil similar to Heiden clay, except that it is noncalcareous throughout the profile. These included soils make up about 14 percent of any mapped area.

About 80 percent of the acreage of this soil is in pasture, and the rest is cultivated. A high percentage of the acreage now in pasture formerly was cultivated. The hazard of erosion is moderate. Capability unit IIIe–2; pasture and hay group 7A; Rolling Blackland range site.

Heiden clay, 3 to 5 percent slopes, eroded (HaC2).—This gently sloping soil is on upland breaks, on the steeper part of side slopes, and on ridgetops. The areas are gullied. The soil areas are irregular in shape and generally follow the contour of the land. They average about 35 acres in size.

The surface layer is very dark grayish-brown clay about 34 inches thick. Below the surface layer to a depth of about 50 inches is mottled, light olive-brown and dark grayish-

brown calcareous clay. The underlying material, to a depth of about 80 inches, is light olive-gray with light yellowish-brown and olive-yellow, firm shaly clay grading to calcareous shale.

Included with this soil in mapping are areas of Ferris and Houston Black soils. These included soils make up about 15 percent of any mapped area.

About 70 percent of the acreage of this soil is in pasture, most of which formerly was cultivated. The rest of the areas are cultivated. The areas generally are dissected by broad, V-shaped gullies that are 10 to 60 feet wide and from 1 to 3 feet deep. These gullies make up about 10 percent of the area. They are difficult to terrace because they require many fills, and water stands in the low places. Capability unit IIIe–3; pasture and hay group 7A; Rolling Blackland range site.

Heiden clay, 5 to 8 percent slopes (HoD).—This sloping soil occupies breaks and also the steeper part of slopes above and below areas of gently sloping soils. The areas are irregular in shape and generally follow the contour of the land. They average about 25 acres in size.

The surface layer is dark grayish-brown, firm clay about 22 inches thick. Below the surface layer is very dark grayish-brown clay that has light olive-brown mottles and extends to a depth of about 42 inches. The underlying material to a depth of about 80 inches is light olive brown and light yellowish-brown, very firm, calcareous clay.

Included with this soil in mapping are areas of Ferris and Houston Black soils and a soil that is similar to Heiden clay, except that it is noncalcareous throughout the profile. These included soils make up about 12 percent of any mapped area.

About 80 percent of the acreage of this soil is in pasture. The remaining 20 percent is cultivated. Some of the acreage now in pasture formerly was cultivated for a short time. The hazard of erosion is severe. Capability unit IVe–2; pasture and hay group 7B; Rolling Blackland range site.

Heiden clay, 5 to 8 percent slopes, eroded (HoD2).—This sloping soil is on breaks and on the steeper part of slopes above and below more gently sloping soils. The areas are gullied. They are irregular in shape, generally follow the contour of the landscape, and average about 25 acres in size.

The surface layer is dark olive-gray, very firm clay about 22 inches thick. Below the surface layer is dark olive-gray clay that has olive-brown mottles. It is calcareous and about 10 inches thick. The underlying material is mottled light brownish-gray, light-gray, grayish-brown, and yellowish-brown, very firm, calcareous clay and extends to a depth of about 80 inches.

Included with this soil in mapping are areas of Ferris and Houston Black soils. These included soils make up less than 15 percent of any mapped unit.

Most of the acreage of this soil formerly was cultivated, but only about 20 percent is now farmed. The remaining 80 percent of the acreage is in pasture. This soil has been greatly damaged through erosion, especially gully erosion. Gullies range from 1 to 5 feet in depth and from about 5 to 60 feet in width. They are broad and V-shaped and make up about 10 to 15 percent of the acreage. These areas are difficult to terrace because they need earth fills, and water stands in the low places. Capability unit IVe-2; pasture and hay group 7B; Rolling Blackland range site.

Houston Black Series

The Houston Black series consists of deep, moderately well drained clay soils that formed in calcareous material. The soils are nearly level to sloping and occupy upland areas. The soil surface is plane to convex. Water enters the soil rapidly if it is dry and cracked, and very slowly if it is moist. Permeability is very slow, and available water capacity is high.

In a representative profile the surface layer is very dark gray, firm clay about 17 inches thick. The next layer, to a depth of about 40 inches, is gray calcareous clay. Below this layer, to a depth of about 90 inches, is light olive-gray clay that has spots of brownish yellow.

Representative profile of Houston Black clay, 1 to 3 percent slopes (100 feet north of a county road, 0.25 mile northeast of Farm Road 1126, and 0.9 mile southeast of intersection of Farm Road 1126 and State Highway 22 at Barry):

Ap—0 to 7 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, medium, granular structure; very hard, firm, very sticky and very plastic; few roots; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—7 to 17 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, medium, angular blocky structure; very hard, firm, very sticky and very plastic; few roots; few calcium carbonate concretions; shiny pressure faces throughout; prominent slickensides; parallelepipeds evident in the lower part, long axes tilted more than 10 degrees from the horizontal; calcareous; moderately alkaline; gradual, wavy boundary.

AC1—17 to 40 inches, gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; streaks of olive yellow and very dark gray; very hard, firm, very sticky and very plastic; few soft masses of lime; some slickensides intersect, but they are not so prominent as those in the A1 horizon; calcareous; moderately alkaline; diffuse, wavy boundary.

AC2—40 to 90 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; spots of brownish yellow; moderate, coarse, blocky structure to massive; very hard, firm, very sticky and very plastic; some seams of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 4 to 46 inches in thickness. It is very dark gray, dark gray, or black. The AC1 horizon ranges from 6 to 38 inches in thickness. It is gray, very dark gray, dark gray, or very dark grayish brown and is mottled in shades of gray, brown, yellow, and olive. In the AC2 horizon color is mottled in shades of gray, yellow, brown, and olive.

Houston Black clay, 0 to 1 percent slopes (HbA).—This nearly level soil occupies broad upland areas. The areas are irregular in shape, but they generally are nearly oval to oblong. They average 55 acres in size.

The surface layer is very dark gray, firm clay about 30 inches thick. The next layer is about 16 inches thick and is a very dark-gray, firm clay that has grayish-brown mottles. Below this is mottled grayish-brown, light olive-brown, dark-gray, and yellow, firm clayey shale to a depth of about 90 inches.

Included with this soil in mapping are areas of Burleson and Wilson soils. These included soils make up about 10 percent of any mapped area.

About 80 percent of the acreage of this soil is cultivated. The rest is in pasture. The native vegetation is tall prairie grasses. Capability unit IIw–2; pasture and hay group 7A; Rolling Blackland range site.

Houston Black clay, 1 to 3 percent slopes (HbB).—This gently sloping soil occupies upland areas. In some places

it is on all of the landscape, on broad watershed divides, on side slopes, and on small drainageways. The areas are very irregular in shape, and they average 110 acres in size.

This soil has the profile described as representative of the series. Included in mapping are areas of Burleson, Ferris, Heiden, and Wilson soils. These included soils make up about 12 percent of any mapped area.

About 60 percent of the acreage of this soil is cultivated. The rest is in pasture. The hazard of erosion is moderate. A few short, shallow gullies occur in some areas, and natural drains are common. Capability unit IIe–1; pasture and hay group 7A; Rolling Blackland range site.

Houston Black clay, 3 to 5 percent slopes (HbC).—This gently sloping soil is on uplands on breaks or the steeper part of the side slopes. The areas generally follow the contour of the land. They average about 35 acres in size.

The surface layer is dark-gray, very firm clay about 16 inches thick. The next layer is dark-gray clay that has mottles of light olive-brown and light brownish gray. It is about 16 inches thick. Below this is a light olive-gray layer that has pale-olive and dark yellowish-brown mottles. It is very firm, calcareous, shaly clay that extends to a depth of about 90 inches.

Included with this soil in mapping are areas of Burleson, Ferris, and Heiden soils. These included soils make up about 12 percent of any mapped area.

About 60 percent of the acreage of this soil is in pasture. The rest is cultivated. The hazard of erosion is moderate. Capability unit IIIe–2; pasture and hay group 7A; Rolling Blackland range site.

Houston Black clay, 2 to 5 percent slopes, eroded (HbC2).—This gently sloping upland soil occupies breaks or the steeper part of the slopes. The areas generally follow the approximate contour of the land, and they average about 35 acres in size.

The surface layer is very dark gray, very firm clay about 26 inches thick. Below the surface layer is dark-gray clay that has mottles of dark grayish brown, light olive brown, and olive yellow. It is about 19 inches thick. Below this is olive-yellow shaly clay that has mottles of light brownish gray and brownish yellow. It extends to a depth of about 90 inches.

Included with this soil in mapping are areas of Ferris, Heiden, and Wilson soils. These included soils make up about 12 percent of any mapped area.

Nearly all of the acreage of this soil formerly was cultivated, but only about 40 percent is now cultivated. The remaining 60 percent is in pasture. This soil has been greatly damaged through erosion, especially gully erosion. Many of the areas are dissected by gullies 5 to 60 feet wide and from 10 to 100 feet apart. About 30 to 60 percent of the eroded areas are cut into by gullies, which are broad, V-shaped, and mainly 2 to 4 feet deep. Capability unit IIIe–3; pasture and hay group 7A; Rolling Blackland range site.

Houston Black clay, 5 to 8 percent slopes (HbD).—This sloping upland soil occurs on the breaks between areas of gently sloping soils. The areas are irregular in shape and generally follow the contour of the land. They average 20 acres in size.

The surface layer is black in the upper part and very dark gray in the lower part. It is a firm clay about 42 inches thick. Below the surface layer, the soil is dark grayish brown and has mottles of light olive brown and light yellowish brown. This layer is clay and is about 8 inches thick. Below this is mottled light olive brown, grayish brown, and brownish yellow calcareous clay that grades to mottled, light brownish-gray and light olive-gray, very firm, calcareous shale that extends to a depth of about 90 inches.

Included with this soil in mapping are areas of Ferris and Heiden soils. These included soils make up about 12 percent of any mapped area.

About 95 percent of the acreage of this soil is in pasture. The remainder is cultivated. The hazard of erosion is severe. Capability unit IVe–2; pasture and hay group 7B; Rolling Blackland range site.

Kaufman Series

The Kaufman series consists of deep, somewhat poorly drained, clayey soils that formed in alluvium. The soils are nearly level and are on flood plains. The soil surface is mainly plane, but it is slightly convex to concave in some areas. These soils have high available water capacity. If they are dry and cracked, water passes through rapidly, and if they are wet, water passes through very slowly. Permeability is very slow.

In a representative profile very dark gray clay extends to a depth of about 62 inches. The upper 6 inches, or the plow layer, is mildly alkaline, but the rest of the profile is moderately alkaline.

Representative profile of Kaufman clay (100 feet west of fence along Interstate Highway 45, and 1.4 miles north of Chambers Creek bridge):

Ap—0 to 6 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak, subangular blocky structure; very hard, firm, very sticky and very plastic; thin surface crust of light gray; few fine roots, mildly alkaline; abrupt, smooth boundary.

A11—6 to 14 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, medium, subangular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; peds have slick surfaces; calcareous; moderately alkaline; clear, smooth boundary.

A12—14 to 62 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots to depth of 40 inches; few thin strata of very fine sand in lower part; moderately alkaline.

Thickness of the solum is 40 to 62 inches. The solum is dark gray to very dark gray. Reaction ranges from medium acid to moderately alkaline. Some profiles have a very dark gray to very dark grayish-brown Bg horizon below 24 inches.

Kaufman clay (Ka).—This nearly level soil occupies flood plains. Most areas are very irregular in shape, but they generally are oval to oblong. Areas average about 100 acres in size. Runoff is slow, and water stands in some areas for short periods. This soil is subject to flooding about once every 4 to 10 years.

This soil has the profile described as representative of the series. Included in mapping are areas of Gowen and Trinity soils. These included soils make up about 12 percent of the delineations.

About 65 percent of the acreage of this soil is in pasture. The rest of the acreage is cultivated. Capability unit IIw–1; pasture and hay group 1A; Bottomland range site.

Kaufman clay, frequently flooded (Kc).—This soil occupies areas adjacent to streams. Some of these areas are undulating because scour channels are numerous. The areas are irregular in shape, but they generally are oblong. They average 90 acres in size. This soil is subject to flooding once every 2 to 3 years during the growing season.

The surface layer is very dark gray, very firm clay about 20 inches thick. Below the surface layer, to a depth of 50 inches, is stratified, very dark gray and very dark grayish-brown, very firm clay. The underlying clayey sediment, to a depth of about 60 inches, is very dark grayish brown, very firm, and mildly alkaline.

Included with this soil in mapping are areas of Gowen and Trinity soils. These included soils make up about 12 percent of any mapped areas.

About 35 percent of the acreage of this soil formerly was cultivated, but it is now in pasture. The rest of the acreage is in range. This soil is not suited to crops because it is subject to frequent and irregular flooding. Water stands in scour channels for long periods. Some broad areas remain wet for several months during some years. Capability unit Vw–1; pasture and hay group 1A; Bottomland range site.

Konawa Series

The Konawa series consists of deep, well-drained soils on uplands in forested areas. These soils are gently sloping to sloping. The soil surface is convex and plane. Slopes range from 1 to 8 percent. These soils have moderate available water capacity and moderate permeability.

In a representative profile the surface layer is light-brown, slightly acid fine sandy loam about 10 inches thick. The next layer, to a depth of about 45 inches, is strongly acid sandy clay loam. It is red in the upper part, yellowish red in the middle part, and reddish yellow in the lower part. The underlying material is reddish yellow, strongly acid loamy fine sand to a depth of about 61 inches.

Representative profile of Konawa fine sandy loam, 3 to 8 percent slopes (370 feet northwest of a fence, 0.5 mile northeast of a county road, 0.45 mile northeast of store at Rural Shade, and 4.0 miles southeast along county road):

A1—0 to 10 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) moist; weak, subangular blocky structure; slightly hard, very friable; few fine roots; common worm casts; slightly acid; clear, smooth boundary.

B21t—10 to 25 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate, coarse, prismatic structure that breaks to moderate, medium, subangular blocky; very hard, firm, slightly sticky and plastic; clay films on ped faces and bridging sand grains; few roots; few fine iron concretions; strongly acid; gradual, smooth boundary.

B22t—25 to 36 inches, yellowish-red (5YR 5/6) sandy clay loam, darker yellowish red (5YR 4/6) moist; moderate, coarse, prismatic structure that breaks to moderate, coarse, blocky; very hard, firm, slightly sticky and plastic; few fine roots; clay films on ped surfaces and bridging sand grains; strongly acid; gradual, smooth boundary.

B3—36 to 45 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; weak, coarse, prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; strongly acid; gradual, wavy boundary.

C—45 to 61 inches, reddish-yellow (7.5YR 7/6) loamy fine sand, strong brown (7.5YR 5/6) moist; structureless (single grain); soft, loose; few fine roots; strongly acid.

The A1 horizon ranges from 3 to 18 inches in thickness. It is grayish brown, brown, yellowish brown, light brown, very pale brown, or reddish yellow. The B2t horizon ranges from 12 to 40 inches in thickness. It is red, yellowish red, or reddish yellow. The content of clay in the upper 20 inches of the B2t horizon ranges from 18 to 35 percent. The B3 horizon ranges from 9 to 28 inches in thickness. It is reddish yellow or yellowish red. The C horizon is reddish yellow to very pale brown.

Konawa fine sandy loam, 1 to 3 percent slopes (KoB).—This gently sloping soil is on uplands. The areas are irregular in shape, and they average about 20 acres in size.

The surface layer is brown, very friable fine sandy loam about 12 inches thick. The next layer is sandy clay loam about 33 inches thick. The upper part is red, and the lower part is yellowish red and is strongly acid. The underlying material is reddish yellow, soft loamy fine sand to a depth of about 60 inches.

Included with this soil in mapping are areas of Axtell, Dougherty, Freestone, Lufkin, Nimrod, and Patilo soils. These included soils make up about 12 percent of any mapped area.

About 95 percent of the acreage of this soil is in pasture, and the rest is cultivated. Most of the acreage is cleared, and formerly was cultivated. The hazard of erosion is moderate. Capability unit IIe–3; pasture and hay group 8C; Sandy Loam range site.

Konawa fine sandy loam, 3 to 8 percent slopes (KoD).—This gently sloping to sloping upland soil occupies the steeper part of the landscape. The areas generally follow the contour of the land. They are irregular in shape and average 30 acres in size.

This soil has the profile described as representative of the series. Included in mapping are areas of Axtell, Nimrod, and Patilo soils. These included soils make up about 12 percent of any mapped area.

This Konawa soil is used mainly for pasture. Most of the acreage is cleared and formerly was cultivated. The hazard of erosion is moderate to severe. Capability unit IIIe–6; pasture and hay group 8C; Sandy Loam range site.

Konawa fine sandy loam, 5 to 8 percent slopes, eroded (KoD2).—This sloping soil is on uplands. It occupies the steeper part of the landscape. The areas are irregular in shape and generally follow the contour of the land. The areas average 20 acres in size.

The surface layer is light yellowish-brown, friable fine sandy loam about 6 inches thick. The next layer is sandy clay loam about 44 inches thick. The upper part is red, and the lower part is yellowish red and strongly acid. The underlying material is yellowish-red loamy fine sand to a depth of about 60 inches.

Included with this soil in mapping are areas of Axtell soils. These included soils make up about 12 percent of any mapped area.

All of the acreage of this soil is cleared. Nearly all of the acreage formerly was cultivated, but all of it is now in pasture. The hazard of erosion is severe. This soil is subject to sheet and gully erosion. Most areas are cut by gullies about 100 to 400 feet long, 3 to 8 feet deep, and 5 to 30 feet wide. The distance between gullies is 10 to 200 feet. Capability unit IIIe–7; pasture and hay group 8C; Sandy Loam range site.

Lamar Series

The Lamar series consists of moderately deep, well-drained, calcareous, loamy soils. These soils are gently sloping to strongly sloping and are on uplands. The soil surface is convex and plane. Lamar soils are moderately permeable, and they have high available water capacity.

Lamar soils typically have a clay loam texture and are calcareous to a depth of about 62 inches. In a representative profile the surface layer is grayish brown and about 4 inches thick. The next layer is about 28 inches thick. It is light yellowish brown in the upper part and olive yellow in the lower part. The underlying material is brownish yellow.

Representative profile of Lamar clay loam, 3 to 8 percent slopes (290 feet south of a fence and approximately 1,450 feet east of county road, 1.4 miles north of "Y" at Chambers Creek on road between Pettys Chapel and Roane, or 3.5 miles south on gravel road from Tupelo Methodist Church):

A1—0 to 4 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky and granular structure; hard, friable, sticky and plastic; few fine roots, many worm casts; many fine pores; calcareous; moderately alkaline; clear, smooth boundary.

B21—4 to 18 inches, light yellowish-brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; moderate fine, subangular blocky structure; hard, friable, sticky and plastic; common grass roots; many fine pores; common worm casts; few to common, fine, indurated calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

B22—18 to 32 inches, olive-yellow (2.5Y 6/6) clay loam, light olive brown (2.5Y 5/6) moist; moderate, fine, angular and subangular blocky structure; hard firm, sticky and plastic; many fine roots; few worm casts; common soft masses of calcium carbonate and fine, indurated, calcium carbonate concretions; calcareous; moderately akaline; gradual, smooth boundary.

C—32 to 62 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) moist; structureless (massive); few horizontal cleavage planes; very hard, friable, sticky and plastic; few fine roots; many soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 3 to 13 inches in thickness. It is grayish brown, very dark grayish brown, light yellowish brown, or olive yellow or brownish yellow. The B2 horizon ranges from 10 to 40 inches in thickness. It is light yellowish brown, dark grayish brown, grayish brown, light olive brown, olive, or olive yellow. The C horizon is white, light olive brown, pale olive, brownish yellow, or yellow.

Lamar clay loam, 3 to 8 percent slopes (LaD).—This gently sloping to sloping soil occupies areas adjacent to the major streams. About 69 percent of this soil is noncalcareous in the upper 15 to 20 inches. The areas are irregular in shape and generally follow the contour of the land. They average 20 acres in size.

This soil has the profile described as representative of the series. Included in mapping are areas of Chickasha, Ferris, Heiden, and Venus soils. Also included are areas of Lamar soils, eroded. These included soils make up about 12 percent of any mapped area.

This Lamar soil is used only for pasture. The hazard of erosion is moderate to severe. Capability unit IVe–3; pasture and hay group 7C; Loam range site.

Lamar clay loam, 5 to 12 percent slopes, eroded (LaE2).—This gently sloping to strongly sloping soil is on breaks to creeks. Slopes are convex. The areas are irregular in shape and generally follow the contour of the land. They average about 25 acres in size. Deep, U-shaped, uncrossable gullies occur in some areas.

The surface layer is light yellowish-brown, friable clay loam about 3 inches thick. The next layer is about 31 inches thick, and is an olive-yellow, calcareous clay loam. The underlying material is yellow, friable clay loam to a depth of about 60 inches.

Included with this soil in mapping are areas of Chickasha and Ferris soils and areas of Lamar soils, uneroded. These included soils make up about 10 percent of any mapped area.

This Lamar soil is used for pasture. Most of the acreage formerly was farmed. The hazard of erosion is severe. Capability unit VIe–2; pasture and hay group 7D; Loam range site.

Lufkin Series

The Lufkin series consists of deep, somewhat poorly drained to poorly drained, nearly level, clayey soils that have a plane to concave surface. Slopes are 1 percent or less. Lufkin soils have high available water capacity. Permeability is very slow.

In a representative profile (fig. 10) the surface layer is fine sandy loam about 8 inches thick. The upper part is light brownish gray, and the lower part is white. The next

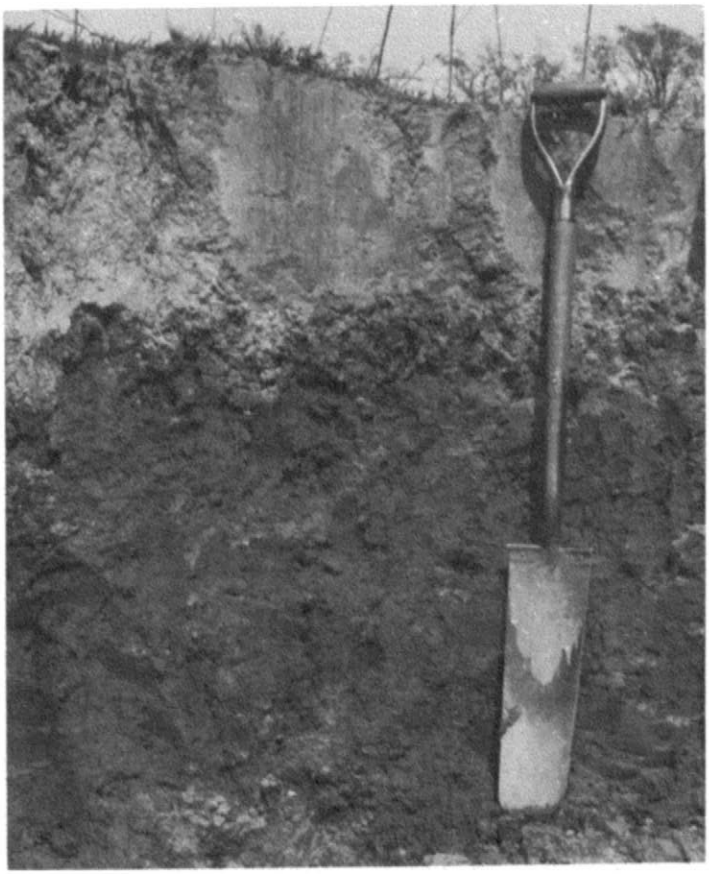

Figure 10.—**Profile of Lufkin fine sandy loam, 0 to 1 percent slopes. Note wavy contact between the surface layer and the next layer.**

lower layer, to a depth of about 45 inches is dense, very firm clay. It is grayish brown to a depth of 20 inches, gray to a depth of about 28 inches, and light gray to a depth of 45 inches. The underlying material is light-gray clay or silty clay to a depth of about 60 inches.

Representative profile of Lufkin fine sandy loam, 0 to 1 percent slopes (southeast of a county road, and 30 feet from road ditch; 1.2 miles southwest, 2.25 miles southeast of State Highway 22, 0.65 mile west of intersection of Highway 22 and Farm Road 55 in Blooming Grove):

A1—0 to 5 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, subangular, blocky structure; hard, friable; many roots; strongly acid; abrupt, smooth boundary.

A2g—5 to 8 inches, white (10YR 8/1) fine sandy loam, light gray (10YR 6/1) moist; structureless (massive); hard, friable, slightly sticky and slightly plastic; few roots; few, fine, siliceous pebbles; strongly acid; abrupt, wavy boundary.

B21tg—8 to 20 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few, medium, distinct mottles of brown; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; distinct clay films on ped faces; few, fine, siliceous pebbles; strongly acid; gradual, wavy boundary.

B22tg—20 to 28 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, medium, faint mottles of grayish brown; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; distinct clay films on ped faces; few iron concretions; few, fine, siliceous pebbles; neutral at a depth of 22 inches and moderately alkaline at a depth of 26 inches; gradual, wavy boundary.

B3g—28 to 45 inches, light-gray (10YR 6/1) clay, gray (10YR 5/1) moist; few, fine, faint mottles of light brownish gray; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; large areas of lime coatings; few, fine, iron concretions; few, fine, siliceous pebbles; moderately alkaline; diffuse, wavy boundary.

C1g—45 to 56 inches, light-gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; structureless (massive); extremely hard, very firm, very sticky and very plastic; few areas of powdery lime and calcium carbonate concretions; few iron concretions; few roots; moderately alkaline; diffuse, smooth boundary.

C2g—56 to 60 inches, light-gray (5Y 7/2) silty clay, light olive gray (5Y 6/2) moist; few, fine, faint mottles of brownish yellow; structureless (massive); extremely hard, very firm, very sticky and very plastic; many masses of powdery lime and calcium carbonate concretions; few iron concretions; moderately alkaline.

The A1 horizon ranges from 2 to 8 inches in thickness. It is light brownish-gray, gray, brown, or pale brown. Reaction is strongly acid to medium acid.

The A2 horizon ranges from 2 to 5 inches in thickness. It is light brownish gray, very pale brown, or white and has a few, fine, faint, yellow, and yellowish-brown mottles. Reaction is strongly acid to medium acid.

The B2t horizon ranges from 20 to 39 inches in thickness. It is dark gray, grayish brown, light brownish gray, or gray and has mottles in shades of gray, brown, or yellow. Reaction is strongly acid to moderately alkaline.

The B3 horizon ranges from 15 to 17 inches in thickness. It is gray to light brownish gray or light gray, and has mottles of light brownish gray or brownish yellow.

The C horizon is light gray or light brownish gray, and has mottles of pale brown to brownish yellow.

Lufkin fine sandy loam, 0 to 1 percent slopes (LuA).—This is the only Lufkin soil mapped in the county. It is in upland claypan areas. The areas are irregular in shape and average 25 acres in size.

Included with this soil in mapping are small areas of Tabor and Nimrod soils. These included soils make up about 12 percent of any mapped area.

About 98 percent of the acreage of this Lufkin soil is in pasture. Only about 2 percent of the acreage is cultivated, though most of the acreage formerly was farmed. Capability unit IIIw–1; pasture and hay group 8A; Tight Sandy Loam range site.

Nimrod Series

The Nimrod series consists of deep, nearly level to gently sloping soils on upland areas. The soil surface is plane to slightly convex. Internal drainage and permeability are moderately slow. Available water capacity is low.

In a representative profile (fig. 11) the surface layer is loamy fine sand about 22 inches thick. The upper 7 inches is light gray and the lower 15 inches is very pale brown. The next layer, to a depth of about 64 inches, is sandy clay loam that is mottled in shades of brown, yellow, gray, and red. The underlying material is light-gray and strong-brown sandy clay loam to a depth of about 86 inches.

Representative profile of Nimrod loamy fine sand, 0 to 2 percent slopes (east of road and 45 feet from fence, 0.15 mile northeast of intersection of Farm Roads 85 and 1129, and 4.9 miles northeast on Farm Road 1129 from its intersection with Farm Road 1603 east of Chatfield):

A1—0 to 7 inches, light-gray (10YR 7/2) loamy fine sand, brown (10YR 4/3) moist; structureless (single grain)

Figure 11.—**Profile of Nimrod loamy fine sand, 0 to 2 percent slopes.**

to weak, subangular blocky structure; loose; few fine roots; common fine pores; few iron concretions; medium acid; clear, smooth boundary.

A2—7 to 22 inches, very pale brown (10YR 7/3) loamy fine sand, yellowish brown (10YR 5/4) moist; structureless (single grain); loose; few fine roots; common fine pores; few iron concretions; medium acid; clear, smooth boundary.

B1t—22 to 27 inches, mottled, light yellowish-brown (10YR 6/4) and brownish-yellow (10YR 6/6) sandy clay loam; moderate, medium, prismatic structure that parts to angular blocky; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; few iron concretions; few patchy clay films on ped faces; medium acid; gradual, smooth boundary.

B21t—27 to 44 inches, mottled, light brownish-gray (10YR 6/2) brownish-yellow (10YR 6/6), and red (2.5Y 4/8) sandy clay loam; weak, medium, blocky structure; very hard, firm, sticky and plastic; clay films on vertical ped faces; few fine roots; common fine root pores; medium acid; gradual, smooth boundary.

B22t—44 to 50 inches, mottled, light brownish-gray (10YR 6/2), brownish-yellow (10YR 6/6), and red (2.5Y 4/8) sandy clay loam; weak, coarse, blocky structure; very hard, firm, sticky and plastic; clay films on ped faces; few fine roots; strongly acid; gradual, smooth boundary.

B23t—50 to 64 inches, mottled, red (2.5YR 4/8), brownish-yellow (10YR 6/6), and light-gray (10YR 6/1) sandy clay loam; weak, coarse, blocky structure; very hard, firm, sticky and plastic; few fine roots; decaying roots in root channels; some clean sand grains; very strongly acid; gradual, wavy boundary.

C—64 to 86 inches, coarsely mottled, light-gray (10YR 6/1) and strong-brown (2.5YR 5/6) sandy clay loam; structureless (massive); hard, friable, slightly sticky and slightly plastic; strongly acid.

The A horizon ranges from 20 to 40 inches in thickness. The A1 horizon is light gray, pale brown, light yellowish brown, or very pale brown. Reaction is medium acid to slightly acid. The A2 horizon is yellow, very pale brown, or light brown. Reaction is strongly acid to neutral.

The B1t horizon ranges from 4 to 7 inches in thickness. It is mottled in shades of red, yellow, and brown. Reaction is strongly acid to medium acid. The B2t horizon ranges from 23 to 40 inches in thickness. It is mottled in shades of gray, red, yellow, and brown. Reaction ranges from very strongly acid to medium acid.

The C horizon is mottled in shades of gray, yellow, and brown. Reaction is strongly acid to medium acid.

Nimrod loamy fine sand, 0 to 2 percent slopes (NmA).—This is the only Nimrod soil mapped in the county. It is on watershed divides and in areas at the base of steeper slopes. The areas are nearly oval to long and narrow. They average 35 acres in size.

Included with this soil in mapping are areas of Freestone, Konawa, Stidham, and Tuckerman soils. These included soils make up about 12 percent of any mapped area.

About 95 percent of the acreage of this Nimrod soil is in pasture, though most of this acreage formerly was cultivated. The remaining 5 percent is cultivated. Capability units IIs–3; pasture and hay group 9A; Sandy range site.

Okemah Series

The Okemah series consists of deep, moderately well drained soils. These nearly level soils occupy broad upland areas. The soil surface is plane to convex. Internal drainage and permeability are slow, and available water capacity is high.

In a representative profile the surface layer is dark grayish-brown loam about 5 inches thick. The next layer is dark grayish-brown clay loam in the upper 7 inches and grayish-brown clay to a depth of 66 inches.

Representative profile of Okemah loam, 0 to 1 percent slopes (50 feet southwest of county road, 0.6 mile northwest, 0.25 mile northeast, and 1.55 miles northwest of junction with State Highway 31 and Farm Road 1393).

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, subangular blocky and weak, fine, granular structure; hard, friable, slightly sticky and slightly plastic; few fine roots and worm casts; few iron concretions; medium acid; abrupt, smooth boundary.

B1—5 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few worm casts; few fine iron concretions; strongly acid; clear, smooth boundary.

B21t—12 to 30 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; common, medium, faint, dark-gray mottles; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine iron concretions; clay films on ped faces, medium acid; gradual, smooth boundary.

B22t—30 to 52 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few, fine, faint, brown mottles; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine iron concretions; clay films on ped faces; mildly alkaline; gradual, wavy boundary.

B3t—52 to 66 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; many, medium, faint, light olive-brown mottles and common, fine, faint, brownish-yellow mottles; weak, coarse, blocky structure to structureless (massive); extremely hard, very firm, very sticky and very plastic, few fine iron concretions; few clay films on ped faces; moderately alkaline; diffuse, wavy boundary.

Cca—66 to 86 inches, mottled, light yellowish-brown (2.5Y 6/4), brownish-yellow (10YR 6/6), olive-yellow (2.5Y 6/6), and light brownish-gray (2.5Y 6/2) clay; structureless (massive); very hard, firm, very sticky and very plastic; approximately 2 percent powdery lime; few to common soft iron concretions; moderately alkaline.

The A horizon ranges from 4 to 8 inches in thickness. It is gray, brown, or dark grayish brown.

The B1 horizon is 4 to 12 inches in thickness. It is dark grayish brown, very dark grayish brown, or brown and has few to common, yellowish-red and light yellowish-brown mottles. The B2t horizon ranges from 10 to 40 inches in thickness. It is grayish brown, dark grayish brown, yellowish brown, or pale brown. The reaction is strongly acid to moderately alkaline. The B3 horizon ranges from 10 to 15 inches in thickness. It is mottled in shades of gray, yellow, and brown. It is mildly alkaline to moderately alkaline.

The C horizon is mottled in shades of gray, brown, and yellow.

Okemah loam, 0 to 1 percent slopes (OkA).—This nearly level soil occupies upland areas. Most areas are slightly convex. The areas are irregular in shape and average 50 acres in size.

Included with this soil in mapping are areas of Crockett and Wilson soils. These included soils make up about 12 percent of any mapped area.

About 70 percent of the acreage of this soil is cultivated, and the rest is in pasture. Capability unit I–4; pasture and hay group 7C; Loam range site.

Patilo Series

The Patilo series consists of deep sandy soils. The soils are gently sloping to sloping and are on uplands. The soil

surface is plane to convex. These soils have moderately slow permeability and low available water capacity.

In a representative profile the surface layer is loamy fine sand about 66 inches thick. In sequence from the top, it is 6 inches of brown, 30 inches of pale brown, and 30 inches of very pale brown. The next lower layer, to a depth of about 132 inches, is a reddish-yellow sandy clay loam that has light-gray mottles. The underlying material to a depth of 140 inches is brownish-yellow sandy loam.

Representative profile of Patilo loamy fine sand, 1 to 8 percent slopes (northwest of private road, 100 feet from fence, northwest 4.1 miles from State Highway 31 at Kerens on Farm Road 636, then northwest 0.35 mile, northeast 0.65 mile, northwest 0.45 mile, and 1.2 miles northeast) :

Ap—0 to 6 inches, brown (10YR 5/3) loamy fine sand, dark yellowish brown (10YR 3/4) moist; structureless (single grain) to weak, fine, angular blocky structure; soft, loose; few roots; slightly acid; abrupt, smooth boundary.

A11—6 to 36 inches, pale-brown (10YR 6/3) loamy fine sand, brown (7.5YR 5/4) moist; structureless (single grain) to weak, fine, subangular blocky structure; soft, loose; few roots; few, very fine, iron concretions; slightly acid; gradual, smooth boundary.

A21—36 to 48 inches, very pale brown (10YR 8/3) loamy fine sand, brown (7.5YR 5/4) moist; structureless (single grain) ; soft, loose; few fine roots; few, very fine, iron concretions; slightly acid; gradual, smooth boundary.

A22—48 to 66 inches, very pale brown (10YR 8/3) loamy fine sand, light yellowish brown (10YR 6/4) moist; few, medium, distinct, reddish-brown mottles; structureless (single gain) ; soft, loose; few, soft, iron concretions up to one-half inch in diameter; few, very fine, siliceous pebbles; slightly acid; gradual, smooth boundary.

B21t—66 to 106 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; many coarse, prominent, light-gray mottles; weak, coarse, subangular blocky structure; hard, friable, sticky and plastic; few soft and few strongly cemented iron concretions as much as one-fourth inch in diameter; medium acid; diffuse, smooth boundary.

B22t—106 to 132 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; few, fine, faint, reddish-yellow and very pale brown mottles; weak, coarse, blocky structure to structureless (massive) ; hard, friable, slightly sticky and slightly plastic; medium acid; gradual, wavy boundary.

C—132 to 140 inches, brownish-yellow (10YR 6/6) sandy loam, yellowish brown (10YR 5/6) moist; structureless (massive) ; slightly hard, very friable, slightly sticky and slightly plastic; few iron concretions one-half inch in length.

The A horizon ranges from 40 to 80 inches in thickness. The A1 is light brownish gray, pale brown, brown, yellowish brown, brownish yellow, or reddish yellow. Reaction is slightly acid or neutral. The A2 horizon is very pale brown, yellowish brown, or yellow.

The B2t horizon is reddish yellow to brownish yellow and has mottles of light gray, red, yellow, and brown.

Patilo loamy fine sand, 1 to 8 percent slopes (PaD).—This is the only Patilo soil mapped in the county. This gently slopping to sloping soil is on uplands. The areas are irregular in shape and average 30 acres in size.

Included with this soil in mapping are areas of Dougherty, Nimrod, Stidham, and Tuckerman soils. These included soils make up about 12 percent of any mapped area.

About 95 percent of the acreage of this soil is in pasture, and the rest is cultivated. The acreage in pasture is cleared, and most of it formerly was farmed. This soil is susceptible to soil blowing. Capability unit IIIs-2; pasture and hay group 9B; Sandy range site.

Pursley Series

The Pursley series consists of well-drained, calcareous soils that formed in alluvium. These nearly level soils are on flood plains of small streams and along the outer edges of larger streams. The soil surface is plane and slightly convex. Permeability is moderate, and available water capacity is high.

In a representative profile the surface layer is dark grayish-brown clay loam about 14 inches thick. The next layer, to a depth of about 32 inches, is grayish-brown loam. The underlying material is grayish-brown clay loam in the upper 8 inches, stratified thin layers of slightly sandier and slightly more clayey sediment in the next 20 inches, and stratified, olive silty clay loam, dark grayish-brown silty clay, and olive-gray, calcareous loam to a depth of about 66 inches.

Representative profile of Pursley clay loam (110 feet southwest of private road, 0.05 mile southeast of county road, 1.3 miles northeast on county road and 2.2 miles east of Dawson on Farm Road 709) :

A1—0 to 14 inches, dark grayish-brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; weak, very fine and medium, granular structure; hard, friable, sticky and plastic; few fine roots; few fine pores; common worm casts; calcareous; moderately alkaline; clear, smooth boundary.

B—14 to 32 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, subangular blocky and granular structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; common worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

C1—32 to 40 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common, fine, faint, pale-brown layers associated with bedding planes; structureless (massive) ; hard, friable, slightly sticky and slightly plastic; few fine roots; common bedding planes; calcareous; moderately alkaline; gradual, smooth boundary.

C2—40 to 60 inches, stratified, olive (5Y 5/3) silty clay loam and dark grayish-brown (2.5Y 4/2) silty clay, few, pale-brown strata along bedding planes; structureless (massive) ; very hard, firm, sticky and plastic; common threads of calcium carbonate along bedding planes; calcareous, moderately alkaline; clear, smooth boundary.

C3—60 to 66 inches, olive-gray (5Y 5/2) loam, darker olive gray (5Y 4/2) moist; structureless (massive) ; bedding planes; hard, friable, slightly sticky and slightly plastic; few threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 7 to 20 inches in thickness. It is dark gray, very dark gray, dark grayish brown, or brown.

The B and C horizons are stratified. They are light brownish gray, black, dark grayish brown, grayish brown, olive gray, or olive. The texture ranges from clay to fine sandy loam.

Pursley clay loam (Pr).—This soil occupies flood plains of creeks. Most of the areas are subject to flooding about once every 4 to 10 years, but a few areas are protected by flood-prevention structures and levees. The areas generally are long and irregular in shape, and they occur on slightly higher elevations as natural levees along the channel or along the outer part of flood plains. The areas average about 55 acres in size.

This soil has the profile described as representative of the series. Included in mapping are areas of Bunyan, calcareous variant, and Gowen and Trinity soils. These included soils make up about 15 percent of any mapped area.

About 60 percent of the acreage of this Pursley soil is in pasture; almost all of this acreage was formerly cultivated. About 40 percent of this soil is cultivated. Capability unit I–1; pasture and hay group 1C; Bottomland range site.

Pursley clay loam, frequently flooded (Ps).—This soil is in low areas adjacent to stream channels and along smaller streams. It extends the width of the flood plain. The areas are irregular in shape. They are long and narrow and average about 55 acres in size. In some places areas have numerous scour channels, but other areas have very few. It is subject to flooding once every 2 to 3 years during the growing season.

The surface layer is dark grayish-brown clay loam about 11 inches thick. Below the surface layer, to a depth of 40 inches, the soil is stratified, light brownish-gray, friable, calcareous fine sandy loam and dark grayish-brown, firm, calcareous clay loam. The underlying sediment is stratified, light brownish-gray, friable fine sandy loam and clay and extends to a depth of about 60 inches.

Included with this soil in mapping are areas of Bunyan, calcareous variant, and Gowen and Trinity soils. These included soils make up about 12 percent of any mapped area.

This Pursley soil is used for pasture. Some of the acreage formerly was cultivated for a short time, but this soil is not suited to crops because of frequent and irregular flooding. Capability unit Vw-1; pasture and hayland group 1C; Bottomland range site.

Purves Series

The Purves series consists of shallow, well-drained, calcareous, clayey soils over limestone. These gently sloping soils are on uplands. The soil surface is convex and plane. They have moderately slow permeability and low available water capacity.

In a representative profile the surface layer is calcareous clay about 18 inches thick over limestone. The upper 9 inches is very dark gray, and the lower 9 inches is dark grayish brown.

Representative profile of Purves clay in an area of Purves rocky clay, 1 to 5 percent slopes (200 feet west of private road, 4.05 miles southwest of Richland on Farm Road 1394, then 0.4 mile north on private road):

A11—0 to 9 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, medium, granular structure; very hard, firm, very sticky and very plastic; few fine roots; common limestone cobblestones about 4 to 6 inches in diameter; few iron concretions and quartz pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

A12—9 to 18 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong, medium, granular structure; very hard, firm, very sticky and very plastic; few fine roots; few fine siliceous pebbles; common, strongly cemented, calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

R—18 to 20 inches, indurated limestone bedrock.

The A horizon ranges from 8 to 20 inches in thickness. It is dark gray, very dark gray, or dark grayish brown. Limestone fragments make up as much as 20 percent of the mass, by volume.

Purves rocky clay, 1 to 5 percent slopes (PuC).—This gently sloping soil occupies areas in and adjacent to natural drains and on the sides of ridgetops. The areas are irregular in shape and average 40 acres in size.

Included with this soil in mapping are areas of Altoga, Engle, Heiden, and Houston Black soils. These included soils make up about 12 percent of any mapped area.

All of this Purves soil is in pasture. It is too rocky to be cultivated, and some areas are too rocky to be mowed (fig. 12). In some areas, especially up and down the slopes, bedrock is exposed in rows. Limestone cobbles and rocks as much as 10 feet in diameter generally are on the surface of this soil. In some places they are 5 to 20 feet apart, but in other places they are scattered on the surface. Capability unit VIs-1; pasture and hay group 13A; no range site assigned.

Stidham Series

The Stidham series consists of deep, well-drained, gently sloping soils. The soil surface is convex and plane. Permeability is moderate, and available water capacity is low.

In a representative profile the surface layer is loamy fine sand about 35 inches thick. The upper 5 inches is grayish brown and the lower 30 inches is very pale brown. The next layer, to a depth of 60 inches, is sandy clay loam. It

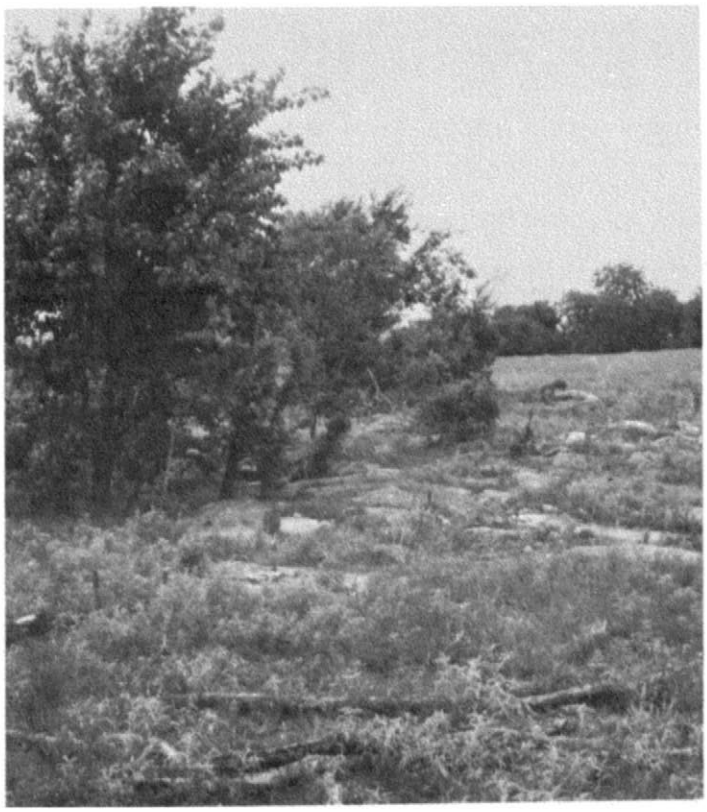

Figure 12.—Area of Purves rocky clay, 1 to 5 percent slopes.

is brownish yellow in the upper part but mottled in shades of brown, yellow, and red in the lower part. The underlying material to a depth of 72 inches is sandy loam mottled in shades of brown, yellow, and red.

Representative profile of Stidham loamy fine sand, 1 to 5 percent slopes (about 1,770 feet south and 4.6 miles east of intersection of State Highways 31 and 309 in Kerens) :

A1—0 to 5 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; structureless (single grain) ; loose; common grass roots; neutral; clear, smooth boundary.

A2—5 to 35 inches, very pale brown (10YR 8/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; structureless (single grain) ; loose; few fine grass roots; few worm casts and pores filled with darker material; common quartz pebbles as much as one-half inch in diameter; slightly acid; clear, smooth boundary.

B21t—35 to 42 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common, medium, faint, strong-brown mottles; weak, coarse, blocky structure to weak, coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few quartz pebbles in upper part; very strongly acid ; clear, smooth boundary.

B22t—42 to 54 inches, coarsely mottled, brownish-yellow (10YR 6/6), very pale brown (10YR 7/3), and reddish-yellow (7.5YR 6/6) sandy clay loam; weak, coarse, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few organic stains; few, fine, semi-indurated and soft iron concretions; very strongly acid ; clear, smooth boundary.

B3—54 to 60 inches, coarsely mottled, very pale brown (10YR 7/4), brownish-yellow (10YR 6/6), and red (2.5YR 4/8) sandy clay loam; weak, coarse, blocky structure to massive; hard, friable, slightly sticky and slightly plastic; few fine quartd pebbles; few, fine, soft iron concretions; the red material contains more sand than the very pale brown or brownish-yellow material, and about 10 percent of the mottles are in shades of red; very strongly acid ; clear, wavy boundary.

C—60 to 72 inches, coarsely mottled, brownish-yellow (10YR 6/6), very pale brown (10YR 7/3), and reddish-yellow (7.5YR 6/6) sandy loams; structureless (massive) ; slightly hard, very friable, slightly sticky and slightly plastic; few fine quartz pebbles; stratified; very strongly acid.

The A1 and A2 horizon combined range from 20 to 40 inches in thickness. The A1 horizon is light gray, grayish brown, light yellowish brown, or very pale brown. Reaction is slightly acid to neutral. The A2 horizon is light brownish gray, light yellowish brown, yellow, or very pale brown. Reaction is medium acid to slightly acid.

The Bt2 horizon ranges from 19 to 25 inches in thickness. It is brownish yellow, pale brown, or yellowish brown. Mottles in shades of red, yellow, or brown increase with depth. Structure is blocky to subangular blocky. The B3 horizon ranges from 6 to 12 inches in thickness. It is mottled in shades of red, brown, or yellow.

The C horizon is mottled in shades of white, gray, yellow, red and brown.

Stidham loamy fine sand, 1 to 5 percent slopes (StC).—This is the only Stidham soil mapped in the county. This gently sloping soil is on uplands. The areas are irregular in shape and average 40 acres in size.

Included with this soil in mapping are areas of Axtell, Freestone, Konawa, and Nimrod soils. These included soils make up about 12 percent of any mapped area.

About 95 percent of the acreage of this soil is in pasture; the remaining 5 percent is in crops. Most of the acreage is cleared and formerly was farmed. A few deep gullies cut in some areas. Capability unit IIIe–8; pasture and hay group 9A ; Sandy range site.

Tabor Series

The Tabor series consists of deep, somewhat poorly drained soils. These nearly level soils are on uplands. The soil surface is plane to very slightly convex. Permeability is very slow, internal drainage is very slow, and available water capacity is low.

In a representative profile the surface layer is fine sandy loam. It is grayish brown to a depth of about 8 inches and light brownish gray to a depth of 15 inches. The next layer in sequence from the top is: 9 inches of clay mottled in shades of gray, brown, red and yellow, 12 inches of yellowish-brown clay that has olive and grayish-brown mottles, 12 inches of light olive-brown clay that has yellowish-brown and dark grayish-brown mottles, and 18 inches of light brownish-gray clay loam mottled in shades of olive, yellow, and brown. The underlying material to a depth of 88 inches is light brownish-gray loam that is mottled.

Representative profile of Tabor fine sandy loam, 0 to 1 percent slopes (120 feet southwest from edge of road, 0.9 mile southeast of railroad crossing in Corbet, then 0.9 mile northeast, 0.6 mile southeast, and 0.3 mile northeast) :

A1—0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular and subangular blocky structure; slightly hard, very friable; few fine roots; neutral; clear, smooth boundary.

A2—8 to 15 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium, subangular blocky structure; slightly hard, very friable; few fine roots; very strongly acid ; abrupt wavy boundary.

B21t—15 to 24 inches, prominently mottled, grayish-brown (10YR 5/2), dark-red (2.5YR 3/6), and dark yellowish-brown (10YR 4/4) clay; moderate, coarse blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; clay films on ped faces; few very fine iron concreations; very strongly acid ; gradual, smooth boundary.

B22t—24 to 36 inches, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; common, medium, faint, olive and grayish-brown mottles; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; clay films on ped faces; few very fine iron concretions; strongly acid ; gradual, smooth boundary.

B23t—36 to 48 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common, medium, faint, yellowish-brown mottles and few, fine, faint, dark graylish-brown mottles; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few clay films; few iron concretions up to 3 millimeters in diameter; few fine siliceous pebbles; strongly acid; diffuse, smooth boundary.

B3—48 to 66 inches, light brownish-gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; few, fine, faint, olive-yellow and brown mottles; weak, coarse, blocky structure to structureless (massive) ; very hard, firm, sticky and plastic; few patchy clay films; few iron concretions, some up to 8 millimeters in diameter; mildly alkaline; diffuse, wavy boundary.

C—66 to 88 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; common, medium, distinct, brownish-yellow and light-gray mottles; structureless (massive); very hard, firm, sticky and plastic; few fine iron concretions; mildly alkaline.

The A horizon ranges from 10 to 20 inches in thickness. The A1 horizon is light brownish gray, grayish brown, or brown. Reaction is neutral to medium acid. The A2 is light gray, light brownish gray, or very pale brown. Reaction is very strongly acid to medium acid.

The B2t horizon ranges from 16 to 33 inches in thickness. It is mottled in shades of gray, red, yellow, and brown. Reaction is moderately alkaline to strongly acid. The B3 horizon ranges from 11 to 18 inches in thickness. It is mottled in shades of gray, red, yellow, olive, and brown.

The C horizon is mottled in shades of gray and brown.

Tabor fine sandy loam, 0 to 1 percent slopes (TaA).—This is the only Tabor soil mapped in the county. This nearly level upland soil occurs mostly as broad watershed divides. The areas are irregular in shape and average about 25 acres in size. In some small areas where the surface is slightly undulating, water stands for short periods.

Included with this soil in mapping are areas of Axtell, Freestone, and Lufkin soils. These included soils make up about 12 percent of any mapped area.

About 90 percent of the acreage of this soil is in pasture which is cleared and formerly was cultivated. The remaining 10 percent is cultivated. Capability unit IIIs–1; pasture and hay group 8A; Sandy Loam range site.

Trinity Series

The Trinity series consists of deep, moderately well drained to somewhat poorly drained, calcareous clay soils that formed in alluvium. These nearly level soils are on flood plains. The soil surface is mainly plane, but ranges from slightly convex to concave. The permeability is very slow. Available water capacity is high.

The surface layer in a representative profile is very dark gray, firm clay in the upper 24 inches, dark-gray, very firm clay to a depth of 36 inches, and black, very firm clay to a depth of 58 inches.

Representative profile of Trinity clay, frequently flooded (75 feet northeast of county road, 1.4 miles southeast of cemetery at Cheneyboro. Cheneyboro is 3.3 miles southeast of Navarro):

A11—0 to 24 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, medium, angular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; few fine pores; calcareous; moderately alkaline; clear, smooth boundary.

A12—24 to 36 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; common calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

A13—36 to 48 inches, black (10YR 2/1) clay, same color moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; some nonintersecting slickensides, calcareous; moderately alkaline; gradual, smooth boundary.

A14—48 to 58 inches, black (10YR 2/1) clay, same color moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine calcium carbonate concretions; few fine roots; calcareous; moderately alkaline.

The A1 horizon ranges from 34 to more than 62 inches in thickness. It is dark gray, black, very dark brown, very dark grayish brown, dark grayish brown, or very dark gray.

Trinity clay (Tn).—This soil is on flood plains. In some places it occupies the entire width of the flood plains. The areas are irregular in shape and average 270 acres in size.

In a representative profile the surface layer is very dark gray, very firm clay about 6 inches thick. The next layer, to a depth of 60 inches, is very dark gray and has alternating horizons of dark-gray, very firm, calcareous clay.

Included with this soil in mapping are areas of Bunyan, Gowen, Kaufman, and Pursley soils. These included soils make up about 10 percent of any mapped area.

About 65 percent of the acreage of this soil is used for crops, and 35 percent is in pasture. Following rainy seasons, some areas of this soil are ponded for a short period. Capability unit IIw–1; pasture and hay group 1A; Bottomland range site.

Trinity clay, frequently flooded (Tr).—This soil is on flood plains and occupies the entire flood plain along some of the smaller streams. The areas generally are much longer than they are wide, and some are irregular in shape. The areas average 400 acres in size. In some areas scour channels are numerous, but in other areas they are few. The soil is subject to flooding once every 2 or 3 years during the growing season.

This soil has the profile described as representative of the series. Included in mapping are areas of Bunyan, calcareous variant, and Gowen, Kaufman, and Pursley soils. These included soils make up about 12 percent of any mapped area.

Because flooding is a hazard on this soil, it is not suited to crops. It is used for pasture. Some areas have intermittent scour channels of various depths and widths. In some areas, the soil remains wet for several weeks at a time. Capability unit Vw–1; pasture and hay group 1A; Bottomland range site.

Tuckerman Series

The Tuckerman series consists of deep, poorly drained soils. These soils are nearly level and are in depressions on low-lying upland areas. The soil surface is concave to plane. Permeability is slow, and available water capacity is high.

In a representative profile the surface layer is dark grayish-brown loam in the upper 6 inches and light-gray fine sandy loam in the lower 10 inches. The next lower layer is gray loam to a depth of 30 inches and dark-gray loam mottled dark yellowish-brown to a depth of about 60 inches.

Representative profile of Tuckerman loam, ponded (southeast of Farm Road 85, 50 feet from fence, 0.3 mile northeast of intersection of Farm Roads 85 and 1129 and 4.0 miles north on Farm Road 1129 from its intersection with Farm Road 1603, which is approximately 1.0 mile northeast of Chatfield):

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; common, fine and medium, distinct, brown mottles; weak, fine, granular structure; very hard, firm, slightly sticky and slightly plastic; few roots and worm casts; many brown organic stains; very strongly acid; clear, smooth boundary.

A2g—6 to 16 inches, light-gray (10YR 6/1) fine sandy loam, dark gray (10YR 4/1) moist; common, fine, distinct, yellowish-brown mottles; weak, fine, subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; very strongly acid; clear, smooth boundary.

B21tg—16 to 30 inches, gray (10YR 5/1) loam, dark gray (10YR 4/1) moist; few, fine, distinct, brown mottles; weak, medium, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; strongly acid; clear, smooth boundary.

B22g—30 to 60 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; few, fine, distinct, dark yellowish-brown mottles; moderate, coarse, blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; clay films on ped faces; medium acid.

The A1 horizon ranges from 6 to 18 inches in thickness. It is gray, light gray, dark grayish brown, brown, or light brownish gray and has mottlings of these colors and yellowish brown. The A2 horizon ranges from 8 to 20 inches in thickness. It is white to light gray and has reddish-brown, brown, or yellowish-brown mottles.

The B2t ranges from 13 to more than 44 inches in thickness. It is gray, dark gray, or light brownish gray and is mottled in shades of gray, red, yellow, and brown. It is loam or clay loam. The upper 20 inches of the Bt horizon averages 18 to 35 percent in content of clay. Reaction is very strongly acid to medium acid.

Tuckerman loam, ponded (Tu).—This soil is in depressions on low terraces about 20 to 40 feet above the flood plain. The areas are irregular in shape, and they generally are long and narrow and average 20 acres in size. Some areas appear to be old scour channels.

Included with this soil in mapping are areas of Freestone, Lufkin, Nimrod, and Stidham soils. These included soils make up about 10 percent of any mapped area.

This Tuckerman soil is used for pasture. In many areas of this soil, the drainage outlet end is filled with sediment, and water stands for long periods in most years. The fringes of some areas receive deposits of sandier material from surrounding soils. Fertilizers are not effective unless this soil is artificially drained. Capability unit VIw–1; pasture and hay group 8E; no range site assigned.

Venus Series

The Venus series consists of deep, well-drained, calcareous, loamy soils. These sloping to moderately steep soils are on uplands. The soil surfaces are convex and plane. Permeability is moderate, and available water capacity is high.

In a representative profile these soils are calcareous clay loam to a depth of about 60 inches. The surface layer is about 11 inches thick and is very dark grayish brown. The next layer is light olive brown to a depth of about 20 inches and light yellowish brown to a depth of 48 inches. The underlying material to a depth of 60 inches is mottled light yellowish brown, olive yellow, and brownish yellow.

Representative profile of Venus clay loam in an area of Venus complex, 5 to 15 percent slopes (about 530 feet west of county road, 0.7 mile north of Farm Road 1394, and 4.9 miles southwest of intersection of Farm Road 1394 and State Highway 14 at Richland):

A1—0 to 11 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate, medium and fine, angular blocky structure; hard, friable, sticky and plastic; few fine roots; few fine calcium carbonate concretions; common worm casts, calcareous; moderately alkaline; clear, smooth boundary.

B21—11 to 20 inches, light olive-brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; common, fine, faint, dark-brown mottles; moderate, medium, angular blocky structure; hard, friable, sticky and plastic; few fine roots; few worm casts; few fine calcium carbonate concretions at upper boundary; calcareous; moderately alkaline; gradual, smooth boundary.

B22—20 to 48 inches, light yellowish-brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few fine roots; few fine calcium carbonate concretions and small amount of soft powdery lime; calcareous; moderately alkaline; gradual, smooth boundary.

Cca—48 to 60 inches, mottled, light yellowish-brown and olive-yellow clay loam; few, fine, brownish-yellow mottles in lower part; structureless (massive); hard, friable, sticky and plastic; few fine roots in upper 2 inches; common masses of powdery lime and few calcium carbonate concretions; calcareous; moderately alkaline.

The A horizon ranges from 10 to 16 inches in thickness. It is dark gray, dark grayish brown, or very dark grayish brown.

The B2 is 16 to 39 inches in thickness. It is light yellowish brown or light olive brown and has few to common mottles of light gray, dark grayish brown, dark brown, or light yellowish brown.

The C horizon is mottled in shades of gray, olive, yellow, and brown.

Venus complex, 5 to 15 percent slopes (VeE).—This complex consists of sloping to moderately steep soils on uplands (fig. 13). The areas are irregular in shape. They are mostly long and narrow and generally follow the contour of the land. The areas average 70 acres in size.

Venus soils make up about 54 percent of the complex, Bonham soils 16 percent, a limestone ledge or outcrop, 10 percent, and less extensive soils, 20 percent. Venus soils and the less extensive soils occupy areas below the limestone outcrop. Bonham soils occupy areas at the lower elevations and the sides of drainageways. The limestone outcrop occurs in long, narrow areas on the higher elevations in the complex.

Included with these soils in mapping are areas of Chickasha and Heiden soils. These included soils make up about 10 percent of any mapped area.

All of these soils are used as range. Capability unit VIe–2; pasture and hay group 7D; Loam range site.

Wilson Series

The Wilson series consists of deep, somewhat poorly drained soils. The soil surface is convex to plane. Slopes

Figure 13.—**Typical landscape of Venus complex, 5 to 15 percent slopes.**

are predominantly 0 to 3 percent, but in places they are as much as 5 percent. These soils are very slowly permeable and have high available water capacity.

In a representative profile the surface layer is dark-gray to very dark gray, firm clay loam about 8 inches thick. The next layer is dark-gray, very firm clay in the upper 20 inches and mottled, very firm clay that is grayish brown in the upper part and light brownish gray in the lower part in the next 20 inches. The underlying material to a depth of 60 inches is mottled olive-yellow, light brownish-gray, light olive-gray, and light olive-brown, firm, moderately alkaline clay.

Representative profile of Wilson clay loam, 1 to 3 percent slopes (200 feet southwest of fence along county road, 1.8 miles northwest of intersection of State Highway 22 and Farm Road 1839 northwest of Corsicana, then 1.8 miles southeast and 0.8 mile southwest):

Ap—0 to 3 inches, dark-gray (10YR 4/1.5) clay loam, very dark gray (10YR 3/1.5) moist; structureless (massive); weak, subangular blocky, structure; very hard, firm, sticky and plastic; few fine roots; few quartz pebbles as much as 1 inch in diameter; neutral; abrupt, smooth boundary.

A1—3 to 8 inches, very dark gray (10YR 3/1.5) clay loam, black (10YR 2/1) moist; structureless (massive); weak, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common quartz pebbles as much as 1 inch in diameter; neutral; abrupt, wavy boundary.

B21tg—8 to 20 inches, dark-gray (10YR 4/1.5) clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; clay films on ped faces; few quartz pebbles as much as one-fourth inch in diameter; mildly alkaline; gradual, wavy boundary.

B22tg—20 to 28 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; clay films on ped faces; few fine roots; few quartz pebbles as much as one-fourth inch in diameter; few, very fine, white, noncalcareous concretions; few, fine, calcium carbonate concretions; mildly alkaline; gradual, wavy boundary.

B23tg—28 to 36 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few, medium, distinct, light olive-brown mottles; weak, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few siliceous pebbles as much as one-fourth inch in diameter; common calcium carbonate concretions; few, fine, white, noncalcareous concretions; mildly alkaline; gradual, wavy boundary.

B3g—36 to 48 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; many, fine, distinct, olive-yellow mottles; weak, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine iron concretions; few siliceous pebbles as much as 1 inch in diameter; many calcium carbonate concretions and masses of powdery lime; mildly alkaline; diffuse, wavy boundary.

C—48 to 60 inches, mottled olive-yellow, light brownish-gray, light olive-gray, and light olive-brown clay; structureless (massive); very hard, firm, very sticky and very plastic; common masses of powdery lime, and few calcium carbonate concretions; calcareous; moderately alkaline.

The A horizon ranges from 3 to 18 inches in thickness. It is gray, dark gray, very dark gray, dark grayish brown, very dark grayish brown, or grayish brown. Texture ranges from clay loam to fine sandy loam. Reaction ranges from neutral to medium acid.

The B2tg horizon ranges from 14 to 42 inches in thickness. It is dark gray, very dark gray, dark grayish brown, or light brownish gray. The B3g horizon ranges from 6 to 18 inches in thickness. It is dark grayish brown, light brownish gray, gray, light gray, yellowish brown, dark gray, olive gray, or olive. Mottles are in shades of gray, yellow, brown, and olive. The structure is blocky to subangular blocky. Siliceous pebbles, calcium carbonate concretions, iron concretions, and clay films generally are present. Reaction ranges from slightly acid to moderately alkaline and calcareous.

The C horizon is mottled in shades of gray, yellow, brown, and olive. Texture is clay or silty clay.

Wilson very fine sandy loam, 0 to 1 percent slopes (WlA).—This nearly level soil is on uplands. It occupies broad watershed divides or areas adjacent to streams. The areas are irregular in shape, generally oval to oblong, and they average about 40 acres in size.

The surface layer is grayish-brown, very friable very fine sandy loam about 6 inches thick. The next layer is dark-gray, very firm clay about 18 inches thick. The next lower layer is light gray, very firm clay about 18 inches thick. The underlying material is mottled light gray, light olive brown, and grayish brown, very firm clay to a depth of about 60 inches.

Included with this soil in mapping are areas of Crockett and Okemah soils.

About 90 percent of the acreage of this soil is in pasture and the rest is cultivated. In some areas natural drains occur that head at the fringe of soil areas on watershed divides. Some areas adjacent to streams have a few short gullies caused by runoff from steeper slopes. Capability unit IIIs–3; pasture and hay group 8A; Grayland range site.

Wilson very fine sandy loam, 1 to 3 percent slopes (WlB).—This gently sloping soil is on uplands. The soil areas are irregular in shape and average about 20 acres in size. Natural drains are common within the areas.

The surface layer is grayish-brown, friable, very fine sandy loam about 10 inches thick. The next layer is very dark grayish-brown, very firm clay about 28 inches thick. The next lower layer is yellowish-brown clay mottled in shades of gray, yellow, and brown. It is about 16 inches thick. The underlying material is mottled, light yellowish-brown and yellow, very firm clay that extends to a depth of about 60 inches.

Included with this soil in mapping are areas of Crockett and Bonham soils.

About 90 percent of the acreage of this soil is in pasture and range, and the rest is cultivated. The hazard of erosion is moderate. A few short, shallow gullies occur in some places. Capability unit IIIe–1; pasture and hay group 8A; Grayland range site.

Wilson clay loam, 0 to 1 percent slopes (WnA).—This nearly level soil occupies broad upland areas and smaller areas at the heads of drainageways. The soil areas are irregular in shape and average about 55 acres in size.

The surface layer is dark grayish-brown, friable clay loam about 10 inches thick. The next layer is very dark gray, very firm clay about 24 inches thick. The next lower layer is dark-gray, very firm clay about 16 inches thick. The underlying material is gray, very firm, calcareous clay that extends to a depth of about 60 inches.

Included with this soil in mapping are areas of Burleson, Crockett, and Okemah soils. These included soils make up about 10 percent of any mapped area.

About 60 percent of the acreage of this soil is in pasture, and the rest is cultivated. Capability unit IIIs–3; pasture and hay group 7H; Grayland range site.

Wilson clay loam, 1 to 3 percent slopes (WnB).—This gently sloping soil is on uplands. The areas are irregular in shape and average about 40 acres in size.

This soil has the profile described as representative of the series. Included in mapping are areas of Bonham, Burleson, Crockett, Heiden, and Houston Black soils. These included soils make up about 12 percent of any mapped area.

About 75 percent of the acreage of this soil is in pasture, and the rest is cultivated. This soil has a moderate hazard of erosion. Capability unit IIIe–1; pasture and hay group 7H; Grayland range site.

Wilson clay loam, 3 to 5 percent slopes (WnC).—This gently sloping soil occupies the sides of upland drainageways. The areas generally follow the contour of the land. They generally are irregular in shape, and long and narrow. The areas average about 25 acres in size.

The surface layer is very dark gray, firm clay loam about 4 inches thick. The next layer is dark-gray, very firm clay about 32 inches thick. The next lower layer is dark grayish-brown, very firm, mildly alkaline clay that has yellowish-brown and olive-gray mottles. It is about 18 inches thick. The underlying material to a depth of about 60 inches is light olive-gray, firm, moderately alkaline silty clay.

Included with this soil in mapping are areas of Crockett, Heiden, and Houston Black soils. These included soils make up about 12 percent of any mapped area.

About 90 percent of the acreage of this soil is in pasture. Some of this acreage formerly was cultivated. The hazard of erosion is severe. Capability unit IVe–1; pasture and hay group 7H; Grayland range site.

Wilson clay loam, 2 to 5 percent slopes, eroded (WnC2).—This gently sloping upland soil generally occupies the steeper part of the landscape between gently sloping soils on uplands and natural drainageways, but in places it is on the upper part of side slopes above more sloping soils. The areas are long and narrow and generally follow the contour of the land. The areas average 15 acres in size.

The surface layer is dark-gray, firm clay loam about 4 inches thick. The next layer is dark-gray, very firm clay about 25 inches thick. The next lower layer is dark grayish-brown very firm clay that has light olive-brown mottles. It is 16 inches thick. The underlying material is light-gray, very firm, calcareous clay to a depth of about 60 inches.

Included with this soil in mapping are areas of Crockett and Heiden soils. These included soils make up about 12 percent of any mapped area.

Most of the acreage of this soil formerly was cultivated. About 5 percent of the acreage is now cultivated and 95 percent is in pasture. The areas of this soil have been damaged by either sheet or gully erosion or by both. The gullies are shallow, short, broad, and V-shaped. They are 10 to 45 feet wide and 1 to 2 feet deep. Capability unit IVe–5; pasture and hay group 7I; Grayland range site.

Use and Management of the Soils

The soils of Navarro County are used mainly for cultivated crops, pasture, and range. This section tells how the soils are managed for these purposes and also for wildlife, for engineering, and for town and country planning. A table gives estimated yields of the principal crops grown in the county.

First the capability classification used by the Soil Conservation Service is briefly explained, then management of the soils for the various uses is described. In discussing the use of the soils for crops, for pasture and hay, for range, and for wildlife, the procedure is to describe groups of soils that have similar uses and that require similar management, and then to suggest management suitable for the group.

Management of the Soils for Crops and Pasture[2]

The capability units in the county are described in the pages that follow and suggestions for use and management of the soils are given. In general, the soils in classes I through IV are used mainly for cotton, grain sorghum, corn, and hay, and the soils in classes V and VI are used mostly for pasture and range.

The names of all the soils in any given capability unit can be obtained by referring to the Guide to Mapping Units at the back of this survey. The capability units are not numbered consecutively, because not all of the units used in Texas are in this county.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not taken into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

[2] By JERRY WALLER, agronomist, Soil Conservation Service.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife. (None in this county.)

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (None in this county.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–3, or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

CAPABILITY UNIT I–1

In this unit are deep, nearly level bottom-land soils that have a clay loam surface layer. Permeability is moderate, and available water capacity is high.

The principal crops are cotton, grain sorghum, and corn. Alfalfa and small grain are also grown. Including fertilized sorghum or small grain in the rotation in the cropping system and returning residue from these crops to the soils help to maintain fertility and to improve tilth. Crops on these soils respond well to applications of fertilizer.

CAPABILITY UNIT I–2

In this unit are deep, nearly level bottom-land soils that have a friable loam to fine sandy loam surface layer. Permeability is moderate, and available water capacity is high.

The principal crops are cotton (fig. 14) and grain sorghum. Small acreages of corn, small grain, and alfalfa are also grown. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soils help to maintain fertility and to improve tilth. Crops on these soils respond well to applications of a complete fertilizer.

CAPABILITY UNIT I–3

The only soil in this unit is Freestone fine sandy loam, 0 to 1 percent slopes. It has a very friable fine sandy loam surface layer about 18 inches thick. Permeability is slow, and available water capacity is high.

The principal crops are grain sorghum, hay crops, and cotton. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soil help to maintain fertility and to improve tilth. Crops on this soil respond well to applications of fertilizer.

CAPABILITY UNIT I–4

The only soil in this unit is Okemah loam, 0 to 1 percent slopes. It has a loam surface layer over clayey lower layers. Available water capacity is high. The principal crops are cotton, grain sorghum, corn, and oats. Using a cropping system that includes fertilized sorghum or small grain in the rotation, and returning residue from these crops to the soil help to maintain fertility and to improve tilth. Crops on this soil respond well to applications of fertilizer.

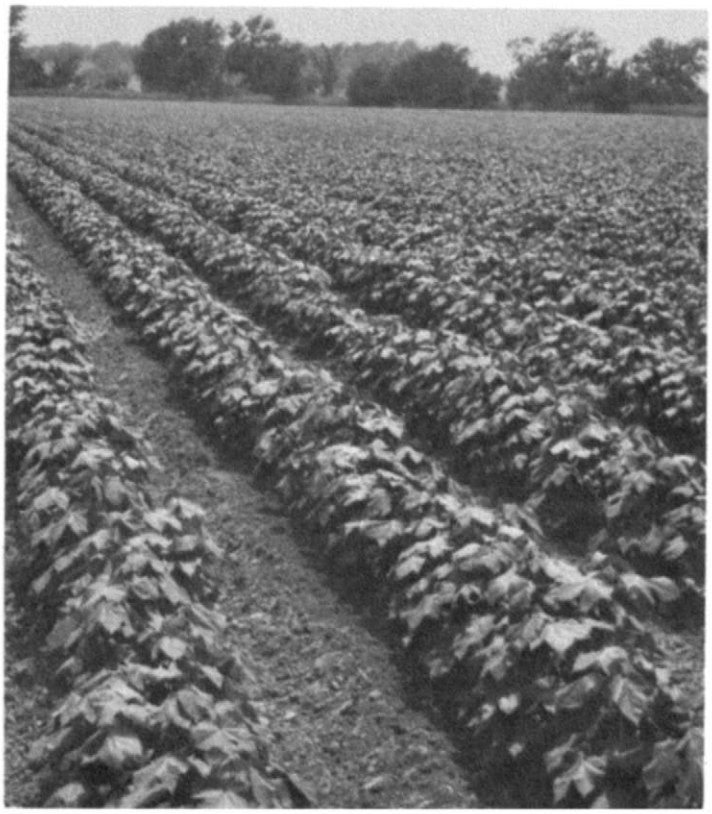

Figure 14.—Cotton on Bunyan loam, calcareous variant.

CAPABILITY UNIT IIe-1

In this unit are deep soils that have a clay surface layer. These soils are very slowly permeable. Available water capacity is high. The hazard of erosion is moderate.

The principal crops are cotton and grain sorghum. Small grains, corn, and winterpeas are also grown. Using a cropping system that includes fertilized sorghum and small grain in the rotation, and returning residue from these crops to the soil help to maintain fertility and to improve tilth. Keeping residue on the surface of these soils helps to control water erosion.

Contour farming (fig. 15) and terracing are needed on these soils. Providing diversion terraces and grassed waterways help to remove outside or excess runoff water.

CAPABILITY UNIT IIe-3

In this unit are deep soils that have a fine sandy loam surface layer. Available water capacity is moderate to high. The hazard of water erosion is moderate.

The principal crops are grain sorghum, corn, and hay crops. Small grain for grazing is also grown. Using a cropping system that includes fertilized sorghum or small grain in the rotation, and returning residue from these crops to the soils help maintain fertility and improve tilth. Keeping residue on the surface of these soils helps to control water erosion. Crops on these soils respond well to applications of a fertilizer that contains nitrogen, phosphorus, and potassium.

Contour farming and terracing are needed on these soils. Providing diversion terraces and grassed waterways help to remove outside or excess runoff water.

CAPABILITY UNIT IIe-5

The only soil in this unit is Bonham loam, 1 to 3 percent slopes. It has a loam surface layer. Available water capacity is high. The hazard of water erosion is moderate.

The principal crops are cotton and grain sorghum. Corn, small grain, vetch, and winterpeas are also grown. Applications of a fertilizer that contains nitrogen, phosphorus, and potassium are needed. Using a cropping system that includes fertilized sorghum and small grain in the rotation, and returning residue from these crops to the soil help to maintain fertility and to improve tilth. Leaving residue on the surface of the soil helps to control water erosion.

Terracing and contour farming are needed on these soils. Providing grassed waterways helps to carry off excess water from the terraces.

CAPABILITY UNIT IIw-1

In this unit are deep, nearly level bottom-land soils that have a thick, very dark gray clay surface layer. These soils are very slowly permeable. Available water capacity is high.

The principal crops are grain sorghum, cotton (fig. 16), corn, small grain, and forage crops. These soils dry slowly because they have a high content of clay and slow internal drainage. They generally are too wet when cultivated, resulting in a poor physical condition, such as a plowpan. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soil help to maintain fertility and to improve tilth. Crops on these soils respond well to applications of fertilizer that contains nitrogen and phosphorus.

In some places diversion terraces are needed to control outside runoff water. In some areas grassed waterways are needed to provide safe outlets for the disposal of water from the diversion terraces.

Figure 15.—Contour rows of cotton and milo on Houston Black clay, 1 to 3 percent slopes. In the foreground is a bermudagrass waterway.

Figure 16.—Cotton on Trinity clay.

CAPABILITY UNIT IIw-2

In this unit are deep, nearly level soils that have a very dark gray clay surface layer. These soils are very slowly permeable. Available water capacity is high.

The principal crops are grain sorghum, cotton, forage crops, corn, and small grain. These soils dry slowly because they have a high content of clay and slow internal drainage. They generally are too wet when cultivated, resulting in a poor physical condition, such as a plowpan. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soils help to maintain fertility and to improve tilth. Crops on these soils respond well to applications of fertilizer that contains nitrogen and phosphorus.

In some places diversion terraces are needed to control outside runoff water. In some fields grassed waterways are needed to provide safe outlets for the disposal of water from the diversion terraces.

CAPABILITY UNIT IIs-3

In this unit are deep, nearly level to gently sloping soils that have a loamy fine sand surface layer. These soils are moderately to moderately slowly permeable. Available water capacity is low, and the hazard of water erosion is slight.

The principal crops are grain sorghum, hay crops, and corn. Crops on these soils respond well to applications of fertilizer that contains nitrogen, phosphorus, and potassium. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soils help to maintain fertility and to improve tilth.

CAPABILITY UNIT IIIe-1

In this unit are deep, gently sloping soils that have a clay loam to fine sandy loam surface layer. These soils are very slowly permeable. The hazard of erosion is moderate.

The principal crops are cotton, grain sorghum, small grain, and corn. Crops on these soils respond well to fertilizers that contain nitrogen, phosphorus, and potassium. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soils help to maintain fertility and to improve tilth. Keeping residue on the surface of these soils helps to control erosion.

Terraces and contour farming are needed on these soils. Providing grassed waterways helps to remove runoff water from the terraces.

CAPABILITY UNIT IIIe-2

These are deep, gently sloping clay soils. They are very slowly permeable. If dry, the soils form a granular mulch on the surface and wide cracks occur. In many areas root rot is a concern in management. The hazard of erosion is moderate. Available water capacity is high.

The principal crops are grain sorghum, cotton, and small grain. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soils help to maintain fertility and to improve tilth. Keeping residue on the surface of these soils helps to control erosion. Crops on these soils respond well to fertilizer that contains nitrogen and phosphorus.

Contour farming, terracing, and grassed waterways are needed on these soils to control excess runoff from the terraces.

CAPABILITY UNIT IIIe-3

In these units are deep, gently sloping, clay soils that are very slowly permeable. Available water capacity is high. If dry, the soils form a granular mulch on the surface and wide cracks occur. In many areas root rot is a concern in management. The hazard of further erosion is moderate. The soil areas are dissected by broad, V-shaped gullies.

The principal crops grown are cotton, grain sorghum, small grain, and hay crops. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue from these crops to the soil help to maintain fertility and to improve fertility. Keeping residue on the surface of these soils helps to control erosion. Crops on these soils respond well to fertilizer that contains nitrogen and phosphorus.

Contour farming, terracing, and grassed waterways are needed to help remove excess runoff water.

CAPABILITY UNIT IIIe-4

In this unit are deep and moderately deep, gently sloping, well-drained clay loams that are moderately permeable. Available water capacity is low to high. The erosion hazard is moderate. Crops on these soils are subject to root rot.

The principal crops are grain sorghum, such hay crops as sorghum and johnsongrass, and small grain for grazing. Leaving all residue from these crops on the surface helps to control erosion and also adds organic material. Crops on these soils respond well to nitrogen and phosphorus.

Terraces and contour farming are needed on these soils to help to control erosion. Providing grassed waterways helps to remove excess runoff water from the terraces.

CAPABILITY UNIT IIIe-6

Konawa fine sandy loam, 3 to 8 percent slopes, is the only soil in this unit. It is moderately permeable. The erosion hazard is moderate to severe. Available water capacity is moderate.

The principal crops are hay crops and some grain sorghum. Keeping residue from these crops on the surface of these soils helps to control water erosion. This practice also helps to maintain or to improve soil tilth. Crops on these soils respond well to applications of fertilizer containing nitrogen, phosphorus, and potassium.

CAPABILITY UNIT IIIe-7

The only soil in this unit is Konawa fine sandy loam, 5 to 8 percent slopes, eroded. It is moderately permeable. Available water capacity is moderate. The hazard of erosion is severe, and sheet and gully erosion occur in most areas.

The principal crop is sorghum for hay and grain. Using a cropping system that includes fertilized sorghum or small grain in the rotation and returning residue to the soil helps to maintain fertility and to improve tilth. Keeping residue on the surface of the soil helps to control erosion. Crops on these soils respond well to applications of fertilizer that contains nitrogen, phosphorus, and potassium.

Terracing and contour farming are needed on these soils to help to control erosion. Providing grassed waterways helps to remove excess runoff water from the terraces.

CAPABILITY UNIT IIIe-8

The only soil in this unit is Stidham loamy fine sand, 1 to 5 percent slopes. Available water capacity is low. The hazard of water erosion is slight.

The principal crops grown are grain sorghum, hay, cotton, and corn. Crops on these soils respond well to fertilizers that contain nitrogen, phosphorus, and potassium. The residue produced by these crops should be returned to the soil to main fertility and to improve tilth.

CAPABILITY UNIT IIIw-1

The only soil in this unit is Lufkin fine sandy loam, 0 to 1 percent slopes. Permeability is very slow. Available water capacity is high.

The principal crops are grain sorghum, hay, cotton, and corn. Crops on these soils respond well to applications of fertilizer that contains nitrogen, phosphorus, and potassium. A suitable cropping system is one that provides a large amount of residue. When left on the surface of the soils after harvest and later plowed into the first few inches of the soil, the residue of these crops helps to maintain fertility and to improve tilth.

CAPABILITY UNIT IIIs-1

In this unit are deep soils that have a fine sandy loam surface layer and clayey lower layers. These soils are very slowly permeable; available water capacity is low to high.

The principal crops are cotton (fig. 17), grain sorghum, corn, and hay crops. Crops on these soils respond well to applications of fertilizer that contains nitrogen, phosphorus, and potassium. A suitable cropping system is one that provides a large amount of residue. When left on the surface of the soils after harvest, the residue of these crops helps to control erosion, to maintain fertility, and to improve tilth.

Figure 17.—**Field of Tabor fine sandy loam, 0 to 1 percent slopes, bedded in preparation for cotton.**

CAPABILITY UNIT IIIs-2

The only soil in this unit is Patilo loamy fine sand, 1 to 8 percent slopes. It is moderately slowly permeable. Available water capacity is low. This soil is susceptible to soil blowing.

The principal crops are sorghum, corn, cotton, and watermelons. Crops on these soils respond well to applications of fertilizer that contains nitrogen, phosphorus, and potassium. A suitable cropping system is one that provides a large amount of residue. When left on the surface of the soil after harvest, and later plowed into the first few inches of the soil, the residue of these crops helps to maintain fertility and to improve tilth.

CAPABILITY UNIT IIIs-3

In this unit are deep, nearly level upland soils that have a fine sandy loam or clay loam surface layer. Permeability is very slow, and available water capacity is high.

The principal crops are grain sorghum, cotton, small grain, and hay crops. Using a cropping system that includes fertilized sorghum and grains and returning residue from these crops to the soil helps to maintain fertility and to improve tilth.

CAPABILITY UNIT IVe-1

In this unit are deep, gently sloping soils that have a surface layer of clay or loam or fine sandy loam. Available water capacity is moderate to high. The hazard of erosion is severe.

The principal crops are grain sorghum, hay crops, and forage sorghum. Leaving residue from these crops on the surface of the soils helps to maintain fertility, to improve tilth, and to control water erosion. These soils respond well to applications of fertilizer that contains nitrogen, phosphorus, and potassium. These soils are well suited to grass.

Such erosion-control structures as terraces and grassed waterways help to remove excess runoff water.

CAPABILITY UNIT IVe-2

In this unit are deep, gently sloping to sloping, calcareous clay soils. They are very slowly permeable. Available water capacity is high. Runoff is rapid, and some of the soils are eroded. If dry, the soils form a granular mulch on the surface, and wide cracks form. In many areas root rot is a concern of management.

The principal crops are grain sorghum, small grain, hay crops, and cotton. Crops on these soils respond well to applications of fertilizer that contains nitrogen and phosphorus. Returning residue of crops to these soils throughout most of or all of the year helps to maintain fertility, to improve tilth, and to control erosion. Terraces are needed on these soils to help control erosion, and grassed waterways are needed to remove excess runoff water. These soils are well suited to grass.

CAPABILITY UNIT IVe-3

In this unit are deep, gently sloping to sloping soils that have a clay loam or fine sandy loam surface layer. These soils are moderately permeable. Available water capacity is high. The hazard of erosion is moderate to severe.

The principal crops are sorghum and hay crops. Leaving residue from these crops on the surface of the soils helps to maintain fertility, to improve tilth, and to control erosion. Crops on these soils respond well to fertilizer

that contains nitrogen, phosphorus, and potassium. These soils are well suited to grass.

Terraces, waterways, and other erosion-control structures are needed on cultivated areas.

CAPABILITY UNIT IVe-5

In this unit are deep, gently sloping soils that have a surface layer of clay loam to fine sandy loam. Available water capacity is high. The hazard of erosion is severe, and all of these soils are eroded.

Only a small percentage of the acreage of these soils is now cultivated, though formerly most of the acreage was cultivated. The principal crops are cotton, grain sorghum, and hay crops. Crops on these soils respond well to fertilizer that contains nitrogen, phosphorus, and potassium. Leaving residue from these crops on the surface of the soils helps to maintain fertility, to improve tilth, and to control erosion.

Terraces and grassed waterways are needed to help to remove excess runoff water.

CAPABILITY UNIT Vw-1

In this unit are deep fine sandy loams to clays on bottom lands. Available water capacity is high. These soils are subject to flooding too frequently to be suitable for cultivated crops. Most areas can support an excellent cover of vegetation.

These soils are suitable for pasture, range, wildlife habitat, and recreational areas.

Maintaining a vegetative cover on these soils is essential. Pasture plants on these soils respond well to applications of fertilizer.

CAPABILITY UNIT VIe-1

In this unit are deep to moderately deep, gently sloping to strongly sloping soils that have a fine sandy loam to clay surface layer. These soils are very slowly permeable. Available water capacity is low to high. Some areas are severely eroded.

The soils of this unit are suitable for pasture, range, wildlife habitat, and recreation.

Natural vegetation needs to be maintained on these soils. Pasture plants on most of these soils respond well to applications of fertilizer containing nitrogen, phosphorus, and potassium. Maintaining a cover of plants on the areas of these soils helps to control erosion.

CAPABILITY UNIT VIe-2

In this unit are sloping to moderately steep soils that have a fine sandy loam to clay surface layer. These soils are moderately permeable to very slowly permeable. Available water capacity is high. Some areas are eroded.

These soils are suitable for pasture, range, wildlife habitat, and recreation areas. Pasture plants on these soils respond well to applications of fertilizer.

A natural vegetative cover needs to be maintained or improved on these soils. Maintaining a vegetative cover on the areas of these soil helps to control erosion.

CAPABILITY UNIT VIw-1

The only soil in this unit is Tuckerman loam, ponded. This nearly level soil is poorly drained and slowly permeable. It occupies low-lying areas.

This soil is suitable for pasture, range, and wildlife habitat. Tuckerman loam, ponded, must be artificially drained before it can be used for pasture. Pasture plants on this soil respond well to applications of fertilizer that contains nitrogen, phosphorus, and potassium.

CAPABILITY UNIT VIs-1

The only soil in this unit is Purves rocky clay, 1 to 5 percent slopes. It is shallow and moderately slowly permeable. Available water capacity is low. Most areas support a good cover of native vegetation.

This soil is suitable for range or for wildlife habitat.

The natural vegetative cover needs to be maintained or improved. Plants on this soil respond well to applications of fertilizer that contains nitrogen and phosphorus. Maintaining a vegetative cover helps to control erosion.

Estimated yields

Estimated yields of the principal crops grown in Navarro County, under a high level of management, are shown in table 2. The estimates are based on the results of research and on information received from farmers and others who have knowledge of the soils and yields in the county.

The high level of management of cropland includes all of the best known methods of farming. The practices used under this level of management are:

1. Rainfall is conserved by using all necessary conservation practices. Among these practices are a properly maintained terrace system, contour farming, and stubble mulching.
2. Crop residue is managed for effective erosion control.
3. Soil fertility is maintained by timely application of fertilizer in kinds and amounts based on soil tests and crop needs and by growing and managing suitable soil-improving crops.
4. Soil tilth is maintained by using a suitable cropping sequence that maintains an adequate supply of organic matter; by tilling, harvesting, and grazing at optimum moisture content to avoid soil compaction; and by using minimum but timely tillage to control weeds and prepare a seedbed.
5. Measures are used consistently and at the proper time for control of insects, disease, and weeds.
6. Improved crop varieties or strains are used.

Absence of a yield figure indicates the crop is seldom grown or the soil is not suitable for its production.

Use of the Soils for Pasture and Hay [3]

In Navarro County, pasture and hay are important for livestock production. The present trend is to use areas for improved pasture and hay that formerly were used for crops. For the past several years much of the acreage formerly used for crops is being planted to introduced grasses each year. Soil areas in improved pasture and hay crops are managed for the high production of forage by use of introduced grasses.

[3] By JERRY WALLER, agronomist, Soil Conservation Service.

TABLE 2.—*Estimated average yields per acre of the principal crops under a high level of management*

[Absence of data indicates that the crop is not suited to the soil or generally is not grown on it]

Soil	Cotton	Corn	Oats	Grain sorghum	Wheat
	Lb. of lint	*Bu.*	*Bu.*	*Lb.*	*Bu.*
Altoga silty clay, 2 to 5 percent slopes	240	35	50	3, 400	25
Axtell fine sandy loam, 1 to 3 percent slopes	225	30	----	3, 000	----
Axtell fine sandy loam, 3 to 5 percent slopes	200	20	----	2, 500	----
Axtell fine sandy loam, 2 to 5 percent slopes, eroded	----	----	----	----	----
Axtell fine sandy loam, 5 to 12 percent slopes	----	----	----	----	----
Bazette silty clay loam, 5 to 20 percent slopes	----	----	----	----	----
Bonham loam, 1 to 3 percent slopes	300	35	50	4, 800	25
Bunyan loam, calcareous variant	450	65	70	6, 500	35
Burleson clay, 0 to 1 percent slopes	400	45	55	5, 500	30
Burleson clay, 1 to 3 percent slopes	320	35	50	4, 800	30
Chickasha fine sandy loam, 3 to 8 percent slopes	----	----	----	----	----
Chickasha soils, 5 to 10 percent slopes, eroded	----	----	----	----	----
Crockett fine sandy loam, 0 to 1 percent slopes	300	45	40	4, 000	20
Crockett fine sandy loam, 1 to 3 percent slopes	300	35	35	4, 000	20
Crockett fine sandy loam, 3 to 5 percent slopes	225	25	30	3, 000	20
Crockett fine sandy loam, 5 to 8 percent slopes	----	----	----	----	----
Crockett soils, 2 to 5 percent slopes, eroded	200	20	30	2, 500	15
Crockett soils, 2 to 8 percent slopes, severely eroded	----	----	----	----	----
Dougherty loamy fine sand, 0 to 3 percent slopes	250	40	----	4, 000	----
Ellis clay, 3 to 12 percent slopes	----	----	----	----	----
Engle clay loam, 1 to 5 percent slopes	----	----	----	----	----
Ferris clay, 3 to 8 percent slopes, eroded	200	30	40	2, 500	20
Ferris and Heiden clays, 5 to 15 percent slopes, eroded	----	----	----	----	----
Ferris and Heiden stony clays, 8 to 15 percent slopes	----	----	----	----	----
Freestone fine sandy loam, 0 to 1 percent slopes	300	40	----	4, 400	----
Freestone fine sandy loam, 1 to 3 percent slopes	225	30	----	3, 800	----
Gowen fine sandy loam	400	55	60	5, 500	30
Gowen fine sandy loam, frequently flooded	----	----	----	----	----
Gowen clay loam	450	60	60	6, 000	30
Gowen clay loam, frequently flooded	----	----	----	----	----
Heiden clay, 1 to 3 percent slopes	350	50	60	5, 500	30
Heiden clay, 3 to 5 percent slopes	300	40	60	4, 500	30
Heiden clay, 3 to 5 percent slopes, eroded	275	40	55	4, 000	25
Heiden clay, 5 to 8 percent slopes	200	30	50	3, 000	20
Heiden clay, 5 to 8 percent slopes, eroded	175	25	45	2, 600	20
Houston Black clay, 0 to 1 percent slopes	450	55	65	6, 000	35
Houston Black clay, 1 to 3 percent slopes	375	50	60	5, 500	30
Houston Black clay, 3 to 5 percent slopes	300	40	60	4, 500	30
Houston Black clay, 2 to 5 percent slopes, eroded	280	35	55	4, 000	25
Houston Black clay, 5 to 8 percent slopes	225	30	50	3, 000	20
Kaufman clay	450	60	60	6, 000	20
Kaufman clay, frequently flooded	----	----	----	----	----
Konawa fine sandy loam, 1 to 3 percent slopes	200	50	----	4, 500	----
Konawa fine sandy loam, 3 to 8 percent slopes	150	25	----	2, 600	----
Konawa fine sandy loam, 5 to 8 percent slopes, eroded	125	20	----	2, 200	----
Lamar clay loam, 3 to 8 percent slopes	225	35	40	3, 600	20
Lamar clay loam, 5 to 12 percent slopes, eroded	----	----	----	----	----
Lufkin fine sandy loam, 0 to 1 percent slopes	175	20	----	2, 500	----
Nimrod loamy fine sand, 0 to 2 percent slopes	250	40	----	4, 500	----
Okemah loam, 0 to 1 percent slopes	350	45	55	5, 500	30
Patilo loamy fine sand, 1 to 8 percent slopes	----	30	----	2, 800	----
Pursley clay loam	450	60	60	6, 000	30
Pursley clay loam, frequently flooded	----	----	----	----	----
Purves rocky clay, 1 to 5 percent slopes	----	----	----	----	----
Stidham loamy fine sand, 1 to 5 percent slopes	250	40	----	4, 500	----
Tabor fine sandy loam, 0 to 1 percent slopes	250	35	----	3, 500	----
Trinity clay	450	60	70	6. 000	20
Trinity clay, frequently flooded	----	----	----	----	----
Tuckerman loam, ponded	----	----	----	----	----
Venus complex, 5 to 15 percent slopes	----	----	----	----	----
Wilson very fine sandy loam, 0 to 1 percent slopes	300	40	40	4, 000	20
Wilson very fine sandy loam, 1 to 3 percent slopes	275	30	35	3, 200	15
Wilson clay loam, 0 to 1 percent slopes	350	50	50	5, 000	20
Wilson clay loam, 1 to 3 percent slopes	325	40	45	4, 200	20
Wilson clay loam, 3 to 5 percent slopes	250	30	40	3, 000	15
Wilson clay loam, 2 to 5 percent slopes, eroded	225	30	40	3, 000	15

Among the important grasses are johnsongrass, Coastal bermudagrass, and common bermudagrass. Increased interest is also being given to indiangrass, kleingrass, and lovegrass. For profitable production the grasses on most soils require a fertilization program.

A greater percentage of the acreage of the county is planted to common bermudagrass and to Coastal bermudagrass than to other grasses. Common bermudagrass can be successfully seeded on sandy soils. Both common bermudagrass and Coastal bermudagrass are sprigged. The sprigging method is more successful than other methods on all soil types.

Pasture and hay groups

This section identifies the soils in Navarro County by pasture and hay groups according to their suitability for the production of forage. The soils in each group are enough alike to be suited to the same grasses, have similar limitations and hazards, require similar management, and have similar productivity and other responses to management. Thus, the pasture or hay group is a convenient grouping of soils for their management.

Good management practices for pasture include fertilization, rotational grazing to maintain proper grazing heights of forage, weed and brush control, and an adequate water supply. Good management practices for hay include fertilization and cutting the forage at the correct height and at the proper stage of growth.

In this subsection, the 16 pasture and hay groups in the county are described. The production of bermudagrass under good management is given for each group in animal-unit-months of production. An animal-unit-month is the number of months per year that one acre will provide grazing for one animal, or 1,000 pounds of live weight. It represents 1,200 pounds of air-dry forage produced.

PASTURE AND HAY GROUP 1A

This group consists of deep, clayey, mildly alkaline to moderately alkaline, calcareous, bottom-land soils. Many areas are subject to flooding several times each year.

The soils in this group are clayey throughout the profile. When these soils are dry, they crack, and water enters the cracks rapidly. When they are wet, the cracks seal, and permeability is very slow. These soils have high available water capacity. The expected animal-unit-months of production is 8.0.

The soils in this group are used for pasture and hay. Common bermudagrass and Coastal bermudagrass are the main grasses (fig. 18). Johnsongrass is commonly cut for hay.

PASTURE AND HAY GROUP 1C

This group consists of loamy, bottom-land soils. These soils have high available water capacity. Fertilizers that contain nitrogen and phosphorous are generally needed for sustained, high forage production.

The soils in this group are used for both pasture and hay. Common bermudagrass, Coastal bermudagrass or johnsongrass have a high production potential. The expected animal-unit-months of production is 8.0.

PASTURE AND HAY GROUP 2A

Bunyan loam, calcareous variant, is the only soil in this group. It is deep, loamy, bottom-land soil. It is moderately permeable and has high available water capacity.

***Figure 18.*—Cattle grazing in pasture of bermudagrass and dallisgrass on Trinity clay in pasture and hay group 1A.**

This soil is used for pasture and hay. Common bermudagrass, Coastal bermudagrass, and johnsongrass are the main grasses. The average expected animal-unit-months of production is 7.0.

PASTURE AND HAY GROUP 7A

This group consists of deep, clayey soils that are very slowly permeable. They have high available water capacity. Fertilizers that contain nitrogen and phosphorus are generally needed for sustained high forage production.

Common bermudagrass and Coastal bermudagrass are the main grasses, but increased acreage is being planted in kleingrass, indiangrass, and lovegrass. About 7.0 animal-unit-months of production can be expected under good management.

PASTURE AND HAY GROUP 7B

This group consists of clay soils that are very slowly permeable. Available water capacity is low to high. Plants on these soils respond if fertilizer that contains nitrogen and phosphorus is applied.

The soils in this group are used mainly for pasture, though a few uneroded areas are used for hay. Common bermudagrass, coastal bermudagrass, and King Ranch bluestem are the main grasses. Under good management about 6.5 animal-unit-months of grazing or forage is produced.

PASTURE AND HAY GROUP 7C

This group consists of loamy and clayey soils that are moderately permeable to slowly permeable. The available water capacity is low to high. Nitrogen and phosphorus fertilizers are needed for high production.

The soils in this group are used for both pasture and hay. Common bermudagrass and Coastal bermudagrass are the main grasses, with increasing acreage being planted in Kleingrass, indiangrass, and lovegrass. About 7.0 animal-unit-months of production can be expected with good management.

PASTURE AND HAY GROUP 7D

This group consists of loamy soils that are moderately permeable. Available water capacity is high.

The soils in this group are well suited to pasture. Coastal bermudagrass and King Ranch bluestem are the main grasses. About 5.0 animal-unit-months of grazing or forage is produced if fertilizer that contains nitrogen and phosphorus is applied.

PASTURE AND HAY GROUP 7H

This group consists of loamy soils that are very slowly permeable. Available water capacity is high. Fertilizer that contains nitrogen, phosphorus, and potassium is needed for high forage production.

The soils in this group are used mainly for pasture. Coastal bermudagrass (fig. 19) and King Ranch bluestem are the main grasses. Bahiagrass and lovegrass are gaining increased use on the soils in this group. Yields of about 5.5 animal-unit-months can be expected under good management.

PASTURE AND HAY GROUP 7I

This group consists of loamy soils that are slowly permeable to very slowly permeable. Available water capacity is high. Fertilizer that contains nitrogen, phosphorus, and potassium is needed.

The soils in this group are used mainly for pasture, though a few areas are used for hay. Coastal bermudagrass and King Ranch bluestem are the main grasses. A production of about 4.0 animal-unit-months can be expected under good management.

PASTURE AND HAY GROUP 8A

The group consists of loamy soils that are deep and very slowly permeable. Available water capacity is low to high. A complete fertilizer that contains nitrogen, phosphorus, and potassium is needed for sustained forage production at high levels.

Figure 19.—**Coastal bermudagrass about 4 months old on Wilson clay loam, 0 to 1 percent slopes, in pasture and hay group 7H.**

The soils in this group are used for pasture and hay. Common bermudagrass and Coastal bermudagrass are the main grasses. Lovegrass and bahiagrass are also grown. A production of 5.5 animal-unit-months can be expected with good management.

PASTURE AND HAY GROUP 8B

This group consists of loamy soils that are deep and very slowly permeable. Available water capacity is moderate to high.

The soils in this group are used mainly for pasture. Coastal bermudagrass, lovegrass, and bahiagrass are the main grasses. A fertilizer that contains nitrogen, phosphorus, and potassium is needed for production of about 5.0 animal-unit-months.

PASTURE AND HAY GROUP 8C

This group consists of deep, loamy soils that are moderately permeable to slowly permeable. These soils have moderate to high available water capacity.

The soils in the group are used for pasture and hay. Common bermudagrass and Coastal bermudagrass are the main grasses. Johnsongrass is also grown on the soils in this group. A complete fertilizer is needed for a production potential of 6.5 animal-unit-months.

PASTURE AND HAY GROUP 8E

The only soil in this group is Tuckerman loam, ponded. In places the soil surface is wet for several months during the year. Reaction is acid.

Tuckerman loam, ponded, is used mainly for pasture. Coastal bermudagrass and bahiagrass are the better adapted grasses. Generally limestone and a complete fertilizer are needed for a production of 6.5 animal-unit-months.

PASTURE AND HAY GROUP 9A

This group consists of deep, sandy soils that are moderately permeable to moderately slowly permeable. These soils have low available water capacity.

The soils in this group are used mainly for pasture, but some areas are managed for hay. Common bermudagrass and coastal bermudagrass are the main grasses. A production potential of 6.5 animal-unit-months can be expected if a complete fertilizer is added at planned intervals during the growing season.

PASTURE AND HAY GROUP 9B

The only soil in this group is Patilo loamy fine sand, 1 to 8 percent slopes. This deep soil is moderately slowly permeable. Available water capacity is low.

This soil is used mainly for pasture, but some of the acreage is in hay. Coastal bermudagrass or lovegrass are the main grasses. The production potential is about 5.5 animal-unit-months if a program that applies complete fertilizer at intervals during the growing season is used.

PASTURE AND HAY GROUP 13A

The only soil in this group is Purves rocky clay, 1 to 5 percent slopes. This soil is shallow and is moderately slowly permeable. Available water capacity is low.

This soil is used for pasture and hay. Coastal bermudagrass and King Ranch bluestem are the principal grasses. The productivity potential is about 4.0 animal-unit-months.

Use of the Soils for Range [4]

Livestock farming is an important enterprise in Navarro County. About 25 percent of the acreage in the county is used for grazing of native species. Some areas that formerly were cultivated are now revegetating by natural means. These areas are not fertilized, and no measures have been used to control weeds and brush on many of them.

Many farm units in the county have some acreage that is managed as range. Many of these units also have some acreage in crops that are grown primarily for producing forage to supplement the grazing of native rangelands.

The major livestock operation is the cow-and-calf enterprise. During years of favorable forage production, many livestock farmers supplement their operations by raising winter stockers, or they carry over calves from the base herd.

Several kinds of plant communities are in the county. The two dominant plant communities are: (1) Tall grass prairie—the climax vegetation is a tall grass prairie of bluestems and associated species—and (2) Savanna—the climax vegetation is an oak savanna with various quantities of grasses (bluestem), grasslike plants (sedges), and forbs (lespedezas and tickclover) occupying the intervening ground area.

Range sites and condition classes

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its potential to produce native plants. Range sites differ from each other in their ability to produce a significant difference in kinds or proportions of plant species or in total annual yield. Significant differences are those great enough to require some variation in management, such as a different rate of stocking.

Differences in kinds, proportion, and production of plants which different sites are capable of supporting are due to differences in environmental factors of soil, topography, and climate. Therefore, range sites can be identified by the kinds of soil known to be capable of producing the distinctive potential plant community which characterizes a specific site.

Most of the rangeland of Navarro County has been heavily grazed for several generations, or it has been farmed and then returned to native grass. The original plant cover has been materially altered. Range condition is the present state of the vegetation of a range site in relation to the potential plant cover for that site. Range condition measures the degree to which the present plant composition, expressed in percent, resembles that of the potential plant community of a range site. Range condition is divided into four condition classes. A range is in *excellent* condition if 76 to 100 percent of the vegetation is the same kind as that in the original stand; it is in *good* condition if the percentage is between 51 and 75; in *fair* condition if the percentage is between 26 and 50; and in *poor* condition if the percentage is 25 or less.

For determining present range condition and for range management purposes, the plants of the potential plant community on a range site are grouped in accordance with their response to continued use of the site. These groups of plants are decreasers, increasers, and invaders.

Decreaser plants are species in the potential plant community that decrease in relative abundance when such a community is subjected to continued moderately heavy to heavy grazing use. Most decreaser plants have a high grazing preference and are the first to decrease from excessive use. The total of all such species is counted in determining range condition.

Increaser plants are species present in the potential plant community that normally increase as the decreasers are reduced when the community is subjected to continued moderately heavy to heavy grazing use. Some increasers with moderately high grazing preference may initially increase and then decrease as grazing pressure continues. Others of low grazing preference may continue to increase either in actual plant numbers or in relative proportions. Only the percentages of increaser plants normally expected to occur in the potential plant community are counted in determining range condition.

Invader plants are not members of the potential plant community for the site. They invade the community, as a result of various kinds of disturbances or years of extremely heavy grazing use. They may be annuals or perennials and may be grasses, weeds, or woody plants. Some have relatively high grazing value, but many are worthless as forage. Invader plants are not counted in determining range condition.

For most range sites and most range livestock operations, the higher the range condition class, the greater is the quality, production, and stability of the available forage.

Descriptions of range sites

The components of soil mapping units that serve to delineate range sites may consist of one or more soil types, phases of soil types, complexes of soil types or phases, undifferentiated units, or miscellaneous land types.

Eight range sites are recognized in Navarro County. Each site is large enough in acreage to be significant in farming programs. These sites are described in this subsection. Management is also briefly discussed. The predicted yields during favorable years are given in pounds of air-dry forage.

BOTTOMLAND RANGE SITE

This site consists of nearly level, deep fine sandy loams to clays on bottom lands. These soils are subject to occasional or frequent flooding and receive runoff from adjacent slopes. They have high available water capacity. Some areas are inundated for several days at a time resulting in complete die-out of the grass stand. Sedimentation and flooding may cause an unstable plant community.

The potential plant community on this site varies because of variations in the amount of water the soil receives and the texture of the soils. The climax plant community on this site is large hardwood trees and varying amounts of underbrush. If the site is in excellent condition, the plant community consists of such decreasers as Eastern gamagrass, Virginia wildrye, switchcane, plumegrass, beaked panicum, purpletop, little bluestem, and sedges. Common increaser species are Florida paspalum, vinemesquite, low panicum, meadow dropseed, longleaf uniola, and stipa. Common invaders are buffalograss, gaping panicum, broomsedge, bluestem, perennial three-awn, windmillgrass, sunflower, cocklebur, broomweed, croton,

[4] DEAN ISSACS, range conservationist, Soil Conservation Service, helped prepare this section.

thistles, and sandbur. Many of the seeds are brought in by runoff water. In some areas elm, hackberry, ash, honey locust, bois d'arc, pecan, persimmon, dogwood, or redbud have invaded, and very few desirable plants remain.

The bottom-land site is well suited to livestock and is often overgrazed. Under such conditions the original productive cover is replaced by stands of brush and weeds, and the value of the site for grazing is diminished. Trees and brush can be controlled by basal treatment with oil and chemicals or by dozing if the stand is not too thick. The site responds favorably to seeding and resting. Seeding may be limited in areas subject to frequently flooding.

The estimated potential yield of air-dry forage on this site is about 8,500 pounds per acre.

GRAYLAND RANGE SITE

This site consists of nearly level to moderately steep, deep or moderately deep fine sandy loams to clays. Some areas are eroded or severely eroded. These soils are slowly permeable to very slowly permeable. Available water capacity is high.

The climax vegetation on this site is mid grasses. The decreasers are little bluestem, indiangrass, big bluestem, Virginia wildrye, vine-mesquite, Florida paspalum, and forbs. The increasers consist of side-oats grama, Texas wintergrass, silver bluestem, longspike tridens, tall dropseed, hairy dropseed, low panicum, low paspalum, purple three-awn, and plains lovegrass. Common invaders are annual grasses and weeds, windmillgrass, buffalograss, Texas grama, tumblegrass, western ragweed, pricklypear, post oak, persimmon, mesquite, elm, hackberry, and hawthorn.

Intensive management is needed to reestablish the decreaser plants. In some areas management to get best production from Texas wintergrass for cool-season use is desirable. Controlling mesquite trees that have invaded this site so that they occupy less than 20 percent of the cover helps to improve the site for plants that grow well in warm weather.

The estimated potential yield of air-dry forage on this site is about 5,000 pounds per acre.

LOAM RANGE SITE

This site consists of nearly level to moderately steep, deep to moderately deep fine sandy loams to clay loams. These soils have low to high available water capacity. They are slowly permeable to moderately permeable.

The climax vegetation on this site is tall grasses. The decreasers are little bluestem, big bluestem, indiangrass, Florida paspalum, and forbs. The principal increasers are Texas wintergrass, side-oats grama, silver bluestem, longspike tridens, meadow dropseed, tall dropseed, vine-mesquite, low panicum, low paspalum, little barley, and purple three-awn. Common invaders are annual grasses and weeds, windmillgrass, buffalograss, Texas grama, tumblegrass, western ragweed, broomsedge, bluestem, yucca, pricklypear, elm, hackberry, mesquite, pricklyash, bois d'arc, honeylocust, and greenbriars (fig. 20).

Recovery of deteriorated ranges on this site can be speeded up by interseeding to desirable grasses. Areas on which brush has invaded can be improved by mechanical or chemical means of brush control, followed by seeding and deferment. This treatment not only restores production, but also provides a better quality of available forage.

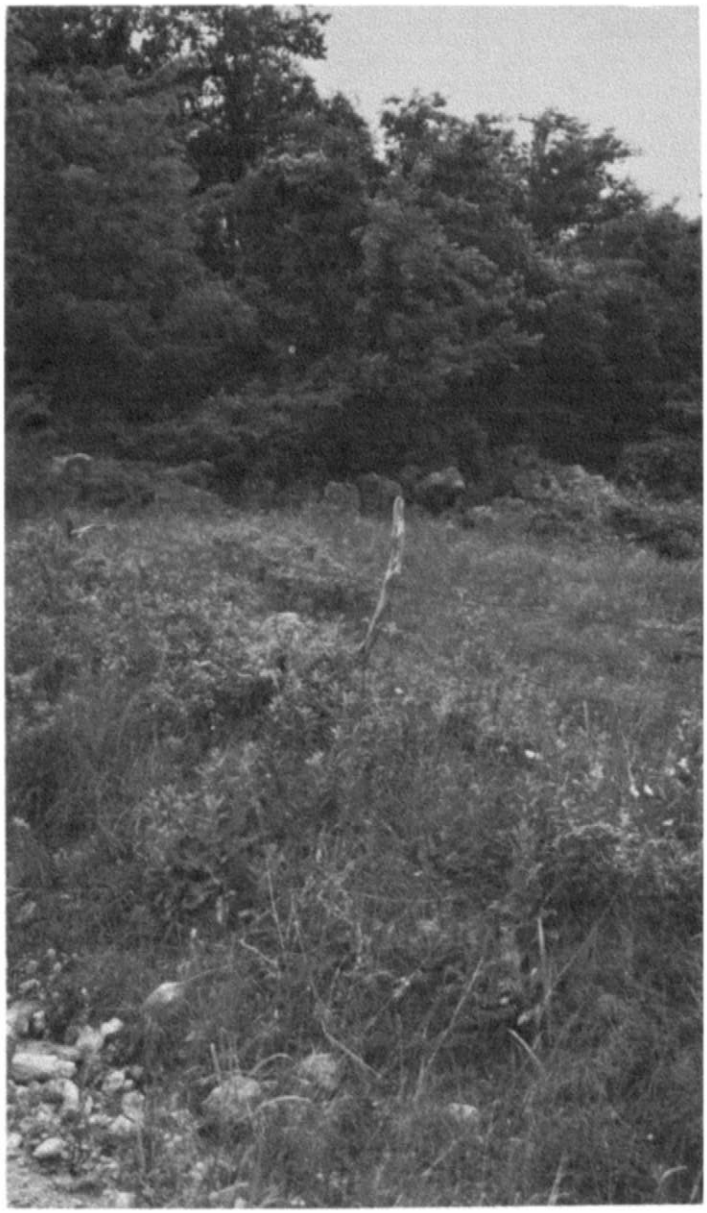

Figure 20.—**Loam range site invaded by weeds, bois d'arc, elm, and hackberry. The soil is Venus clay loam in Venus complex, 5 to 15 percent slopes.**

The estimated potential yield of air-dry forage on this site is about 6,000 pounds per acre.

ROLLING BLACKLAND RANGE SITE

This site consists of nearly level to moderately steep, deep clays and silty clays. Most of these soils crack when they are dry, and water enters the cracks rapidly. When the soils are wet, the cracks seal. Permeability is very slow to moderate. Available water capacity is high.

The climax vegetation on this site is a true prairie with oaks, elm, and hackberry occurring in motts and along draws and small streams. The decreasers are big bluestem, little bluestem, indiangrass, Virginia wildrye, and forbs.

The principal increasers are Florida paspalum, side-oats grama, Texas wintergrass, vine-mesquite, low panicum, low paspalum, purple three-awn, tall dropseed, meadow dropseed, and silver bluestem. Common invaders are annual grasses and weeds, Texas grama, windmillgrass, buffalograss, hairy tridens, tumblegrass, western ragweed, fogfruit, milkweed, prickleypear, mesquite, bois d'arc, elm, hackberry, hawthorn, sumac, and oaks.

Recovery of deteriorated ranges on this site can be speeded up by interseeding to desirable grasses. Areas invaded by brush can be improved by mechanical or chemical means of brush control, followed by seeding and deferred grazing.

The estimated potential yield of air-dry forage on this site is about 6,500 pounds per acre.

SANDY RANGE SITE

The site consists of nearly level to sloping loamy fine sands. The soils are moderately slow to moderately permeable. Available water capacity is low.

The climax vegetation on this site is an open stand of oak trees shading about 20 percent of the ground and grass interspersed between and under trees. The decreasers are little bluestem, indiangrass, beaked panicum, purpletop, sand lovegrass, and climax forbs. The principal increasers are tall dropseed, sand dropseed, Carolina joint tail, low paspalum, longleaf uniola, sedges, woolysheath three-awn, purple lovegrass, and low panicum. Common invaders are annual weeds and grasses, red lovegrass, bullnettle, and broomsedge bluestem. Underbrush is composed of yaupon, red hawthorn, waxmyrtle, beauty-berry, greenbrier, and wild berries. Recovery of deteriorated ranges on this site can be speeded up by interseeding to desirable grasses. Area invaded by brush can be improved by mechanical or chemical brush control followed by seeding and deferment.

The estimated potential yield of air-dry forage on this site is about 5,000 pounds per acre.

SANDY LOAM RANGE SITE

This site consists of nearly level to sloping, deep fine sandy loams. Permeability is very slow to moderate. Available water capacity is low to high. Most of the acreage formerly was cultivated. The climax vegetation on this site is an open stand of oak trees shading about 20 percent of the ground and grass interspersed between and under trees. The decreases are little bluestem, indiangrass, beaked panicum, purpletop, Florida paspalum, sand lovegrass, and climax forbs. The principal increasers are low paspalum, longleaf uniola, Carolina jointtail, purple lovegrass, tall dropseed, meadow dropseed, low panicum, and sedges. Common invaders are annual weeds and grasses, red lovegrass, broomsedge bluestem, western ragweed, American beauty-berry, yaupon, plum, persimmon, post oak, hickory, red haw, greenbrier, and coralberry.

Recovery of deteriorated ranges in this site can be speeded up by interseeding to desirable grasses. Areas invaded by brush can be improved by mechanical or chemical means of brush control, followed by seeding and deferment.

The estimated potential yield of air-dry forage on this site is about 5,500 pounds per acre.

SHALY HARDLAND RANGE SITE

This site consists of gently sloping to strongly sloping, moderately deep clays (fig. 21). When these soils are dry, they crack, and water enters rapidly. When wet, the cracks seal, and permeability is very slow. Available water capacity is low.

The climax vegetation on this site is mid grasses. The decreasers are mainly little bluestem, indiangrass, vine-mesquite, Florida paspalum, and forbs such as scurf-pea and prairie-clover. The increases are side-oats grama, Texas grama, silver bluestem, low panicum, low paspalum, purpletop, three-awn, Wrights three-awn, meadow dropseed, hairy dropseed, rought tridens, tall dropseed, Texas wintergrass, and plains lovegrass. The principal invaders are annual grasses and weeds, tumblegrass, windmillgrass, hairy tridens, Texas grama, buffalograss, western ragweed, milkweed, pricklypear, elm, hackberry, hawthorn, and mesquite.

Recovery of deteriorated ranges on this site can be speeded up by interseeding to desirable grasses. Areas invaded by brush can be improved by mechanical or chemical means of brush control, followed by seeding and deferred grazing.

The estimated potential yield of air-dry forage on this site is about 4,000 pounds per acre.

TIGHT SANDY LOAM RANGE SITE

This site consists of nearly level to strongly sloping, deep fine sandy loams. These soils are very slowly permeable. Available water capacity is moderate to high. Most of the acreage of this site formerly was cultivated.

The climax vegetation is an open stand of oak trees shading about 30 percent of the ground and grass interspersed between and under the trees. The decreasers are little bluestem, indiangrass, beaked panicum, sand lovegrass, Florida paspalum, purpletop, and forbs. The prin-

Figure 21.—**An area of Ellis clay, 3 to 12 percent slopes, in the Shaly Hardland range site.**

cipal increasers are low paspalum, longleaf uniola, Carolina joint tail, purple lovegrass, tall dropseed, meadow dropseed, low panicum, and sedges. The invaders are annual weeds and grasses, red lovegrass, broomsedge bluestem, western ragweed, American beautyberry, elm, pecan, post oak, persimmon, and coralberry.

Recovery of deteriorated ranges on this site can be speeded up by interseeding to desirable grasses. Areas invaded by brush can be improved by mechanical or chemical means of brush control, followed by seeding and deferred grazing (fig. 22).

The estimated potential yield of air-dry forage on this site is about 4,500 pounds per acre.

Use of the Soils for Wildlife

This section provides a description of the major wildlife sites in the county and briefly discusses kinds of wildlife that inhabit each.

Many farmers and ranchers in Navarro County are finding that, under proper management, the use of the soils for wildlife is profitable. The demands for places to hunt and fish are increasing each year, and areas used as wildlife habitats are providing economic returns to the owners from hunting and fishing permits. Much of the acreage of the county is in pasture, range, and formerly cultivated areas. All these areas are well suited to wildlife. Many of the cultivated areas are idle or are in crops that provide seasonal food and cover.

In recent years major wildlife species have increased. Navarro County supports a variety of wildlife. Among more important animals are rabbit, squirrel, skunk, opossum, coyote, fox, raccoon, and armadillo. The main kinds of birds are dove, quail, duck, and songbirds. Largemouth bass, channel catfish, and redear sunfish are suitable for stocking farm ponds and lakes. Other native fish are bullhead catfish and crappie.

Descriptions of wildlife sites

The soils of the county are grouped into four wildlife sites by soil association. The soil associations are shown on the general soil map at the back of this survey and are described in the section "General Soil Map."

Each site is unique in relief, productivity, kinds and amounts of vegetation, and species of wildlife that inhabit the site.

WILDLIFE SITE NUMBER 1

This site consists of nearly level to gently sloping soils of the Crockett-Wilson and Wilson-Burleson associations. The areas are dissected by many intermittent streams.

Much of the acreage in this wildlife site had been farmed at one time, but many fields are now in grass or are idle. The main crops grown in cultivated areas are cotton, grain sorghum, corn, and small grain. Annual and perennial grasses grow in places, and some crops are grown and used for hay and pasture. Other vegetation consists of post oak, persimmon, elm, hackberry, mesquite, paspalum, bluestem, and three-awn.

Wildlife common on this site are rabbit, coyote, skunk, and armadillo. A few squirrel and opposum live in wooded areas along drainageways. Dove and quail are numerous on this site, and songbirds are common. Migrating ducks use the many farm ponds and lakes as resting places. Many of these ponds and lakes are stocked with largemouth bass, channel catfish, and redear sunfish.

Figure 22.—An area of range on Axtell fine sandy loam, 1 to 3 percent slopes, that has been invaded by post oak (top view). A similar area that has been cleared of post oak and brush by mechanical means (bottom view).

WILDLIFE SITE NUMBER 2

This site consists of nearly level to moderately steep soils of the Houston Black-Heiden association. The areas are dissected by intermittent streams.

About half of the acreage in this wildlife site is in cotton, grain sorghum, small grain, and corn. The rest of the acreage is in open pasture and range. Many areas of bermudagrass have been established. Other grasses established are dropseed, silver bluestem, Texas wintergrass, little bluestem, indiangrass, and vine-mesquite. Some areas have a few scattered oak, elm, and hackberry. Vegetation on some of the small bottom-land areas and on the sides of drainageways consists of elm, hackberry, sumac, hawthorne, and other shrubs.

Rabbit, skunk, and coyote are the main wildlife. The lack of cover limits the suitability of this site for such wildlife as squirrel, opposum, fox, and racoon. Dove, quail, songbirds, and migrating ducks are common. Farm ponds, lakes, and reservoirs are stocked with largemouth bass, channel catfish, and redear sunfish.

WILDLIFE SITE NUMBER 3

This site consists of nearly level to strongly sloping soils of the Axtell-Konawa association. The areas are on uplands and are dissected by many short, intermittent streams as side drainageways.

This wildlife site is used mainly for pasture. Some areas are still in native or cut-over timber of post oak, hickory, and other hardwoods. Many areas are idle. Only a small acreage of this site is cultivated. The main crops are grain sorghum, forage sorghum, and a small amount of small grain for grazing. Other vegetation is pecan, persimmon, elm, little bluestem, broomsedge bluestem, johnsongrass, paspalum, plum, greenbriar, and coralberry.

This site is suitable for nearly all the wildlife in the county. Rabbit, squirrel, skunk, opposum, coyote, and armadillo are common on this site. A few fox and racoon inhabit the heavily wooded areas. Dove, quail, songbirds, hawks, and owls also are common on this site. Migrating ducks use the farm ponds as stopover areas. Many of these ponds are stocked with largemouth bass, channel catfish, and redear sunfish.

WILDLIFE SITE NUMBER 4

This site consists of nearly level, deep clayey soils of the Trinity-Kaufman association. The areas of this wildlife site are along the flood plains of the major streams throughout the county. Many areas are frequently flooded.

More than half of the acreage of this site formerly was cultivated, but many of these areas were abandoned because they are subject to flooding. About half of the acreage of this site is in cotton, grain sorghum, and forage crops. Many areas are used for johnsongrass hay, and numerous bermudagrass pastures have been established. Many frequently flooded areas are wooded, and the stands consist of elm, hackberry, honeylocust, ash, bois d'arc, pecan, persimmon, dogwood, and redbud. Other vegetation consists of broomsedge, giant ragweed, Virginia wildrye, sunflower, cocklebur, croton, paspalum, three-awn, and sandbur.

Many squirrels inhabit the wooded areas of this site, though populations are larger in fall, when food is plentiful, than in other seasons. Rabbit, skunk, opposum, coyote, fox, armadillo, and racoon are numerous. Dove, quail, songbirds, hawks, and owls are also numerous. Migrating ducks use the lakes, farm ponds, and large stream channels as stopover areas. These lakes, and most of the ponds, are stocked with fish.

Engineering Uses of the Soils [5]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buidings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 3, 4, and 5, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples. This information, along with the soil map and other parts of this publication can be used to make interpretations in addition to those given in tables 3, 4, and 5. It also can be used to make other useful maps.

The engineering interpretations reported in this survey do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads, nor where the excavations are deeper than the depths of layers reported. Estimates generally are made to a depth of about 5 feet, and interpretations do not apply to greater depths. Also, engineers should not apply specific values to the estimates for bearing capacity and traffic-supporting capacity given in this survey. Investigation of each site is

[5] By WILLIAM L. WEDEL, civil engineer, Soil Conservation Service.

needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for engineering works. Even in these situations, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some of the terms used in this soil survey have a special meaning in soil science that may not be familiar to engineers. These terms are defined in the Glossary.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*8*) used by the SCS engineers, Department of Defense, and others and the AASHO system (*1*) adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 5; the estimated classification, without group index numbers, is given in table 3 for all soils mapped in the survey area.

Engineering properties of the soils

Table 3 provides estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, physical and chemical tests of 6 samples from 6 soil series in Navarro County, test data from comparable soils in adjacent areas, and from detailed experience gained in working with the individual kinds of soil in the survey area. Depth to the water table is not given for the soils, because the water table is at a depth of many feet in most of the soils. In a few places, however, depth to the water table is between 6 and 20 feet as in the Gowen, Kaufman, and Trinity soils.

In the column "Depth to Bedrock," depth is given in inches to where consolidated materials may be found.

Hydrologic soil groups give the runoff potential from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long-duration storms occurring after prior wetting and opportunity for swelling, and without the protective effects of vegetation.

The major soil groups are:

A. (Low runoff potential). Soils having high infiltration rates even when thoroughly wet. They are chiefly deep, well-drained to excessively drained sand or gravel. These soils have a high rate of water transmission in that water readily passes through them.

B. Soils having moderate infiltration rates when thoroughly wet. They are chiefly moderately deep to deep, moderately well drained to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

C. Soils having slow infiltration rates when thoroughly wet. They are chiefly soils with a layer that impedes downward movement of water, or of soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

D. (High runoff potential). Soils having very slow infiltration rates when thoroughly wet. They are chiefly clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary of this soil survey.

Percentage passing sieve is given for soil materials passing four different sieve sizes. This information is useful in helping to determine suitability of the soil as a source of material for construction purposes.

Permeability, as used in table 3, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water capacity is the amount of water a soil can hold and make available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at the time plants wilt. The rate is expressed as inches of water per inch of soil depth.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials.

Engineering interpretations of the soils

Table 4 contains selected information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized. The ratings and other interpretations in this table are based on estimated engineering properties of the soils indicated in table 3; on available test data, including those in table 5; and on field experience. Though the information applies only to soil depths indicated in table 3, it is reasonably reliable to depths of about 6 feet for most soils, and several more for others.

Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, used as a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such use.

The suitability of the soils as a source for sand, gravel, and rock are not given in the table because of the limited quantities of these materials in the county. Good sources of sand and gravel are found in some areas of Trinity clay along the Trinity River. Ferris and Heiden stony clays are a good source of rock, and some areas of Purves rocky clay are a fair source.

Road fill is material used to build embankments. The ratings indicate performance of soil material moved from borrow areas for that purpose.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features, favorable as well as unfavorable, are the principal ones that affect geographical location of highways.

Foundations for low buildings are affected mainly by features of the undisturbed soil that influence its capacity to support low buildings that have normal foundation loads.

Septic tank filter fields are affected mainly by permeability, location of water table, and susceptibility of flooding. The degree of limitations and the principal reasons for assigning moderate or severe limitations are given in table 4.

Sewage lagoons are influenced mainly by soil features such as permeability, location of water table, and slope. The degree of limitation and principal reasons for assigning moderate or severe limitations are given in table 4.

Farm pond reservoir areas are affected mainly by loss of water, by seepage, and the soil features considered are those that influence such seepage.

Farm pond embankments serve as dams. The soil features of both subsoil and substratum are those important to the use of soils for constructing embankments.

Drainage for crops and pasture is affected mainly by those features and qualities of the soil that influence the installation and performance of surface and subsurface drainage systems. Among these features and qualities are permeability, flooding, and availability of outlets.

Irrigation is affected mainly by features and qualities of soils that affect their suitability for irrigation. Such features and qualities include water-holding capacity, water-intake rate, depth of soil, and slope.

Terraces and diversions are affected by features and qualities of soils that influence their stability or hinder layout and construction of terraces and diversions, hazard of sedimentation in channels, and difficulty of establishing and maintaining vegetative cover on diversions.

Grassed waterways are affected by those features and qualities of soils that influence the establishment, growth, and maintenance of plants and factors that hinder layout and construction.

Corrosivity of soils is rated at a depth of 4 feet. Soil properties affecting corrosion of uncoated steel pipe include drainage, texture, acidity, resistivity, and conductivity. Among the soil properties that affect corrosion of concrete are texture, reaction, and the amount of sodium or magnesium sulfate or sodium chloride present in the soil.

Engineering test data

Table 5 contains the results of engineering tests performed by the Texas State Highway Department Testing Laboratory on six profiles of six soil series in Navarro County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

Shrinkage limit refers to the decrease in volume of soil in direct proportion to the loss in moisture until a condition of equilibrium is reached where shrinkage stops although additional moisture is removed. This point of moisture content at which shrinkage stops is called the shrinkage limit of the soil and is reported as the moisture content, by oven-dried weight of soil.

Linear shrinkage is the decrease in one dimension expressed as a percentage of the original dimension of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Shrinkage ratio is the volume change expressed as a percentage of the volume of the dried soil divided by the moisture loss above the shrinkage limit expressed as a percentage of the weight of the dried soil.

Mechanical analyses show the percentage, by weight, of soil particles that can pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve. Silt and clay pass through the No. 200 sieve. Silt is that material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is that fraction passing through the No. 200 sieve that is smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method, rather than the pipette method most soil scientists use in determining the clay in soil samples.

Liquid limit and plasticity index indicate the affect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

TABLE 3.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of this table. Absence of entry in a column indicates

Soil series and map symbols	Depth from surface	Depth to bedrock	Hydrologic group	Classification		
				Dominant USDA texture	Unified	AASHO
	In.	*In.*				
Altoga: AlC	0–8	>60	C	Silty clay	CL or CH	A–7
	8–15			Silty clay	CH	A–7
	15–57			Silty clay loam	CL or CH	A–7
Axtell: AxB, AxC, AxC2, AxE	0–10	>60	D	Fine sandy loam	SM or ML	A–4
	10–46			Clay	CH or CL	A–7
	46–88			Very fine sandy loam to clay.	SM, CL, ML, or CH.	A–4, A–7, or A–6.
Bazette: BaF	0–6	>60	C	Silty clay loam	CL or CH	A–6
	6–22			Silty clay	CL	A–7
	22–34			Silty clay loam	CL	A–7
	34–60			Shaly clay.		
Bonham: BmB	0–9	>60	C	Loam	ML	A–4
	9–19			Clay loam	CL	A–6 or A–7
	19–90			Clay	CH or CL	A–7
Bunyan: Bn	0–20	>60	B	Loam	SM or ML	A–4
	20–65			Clay loam	CL	A–6
Burleson: BuA, BuB	0–30	>60	D	Clay	CH	A–7
	30–63			Clay	CH	A–7
Chickasha: ChD, CkD2	0–8	40–60	B	Fine sandy loam	SM or ML	A–4
	8–24			Sandy clay loam	CL or SC	A–6
	24–45			Loam	ML	A–4
	45–88			Sandstone.		
Crockett: CrA, CrB, CrC, CrD, CtC2, CtD3.	0–7	>60	D	Fine sandy loam	SM, SC, or ML	A–2 or A–4
	7–68			Clay	CH or CL	A–7
	68–92			Clay loam	CL or CH	A–7 or A–6
	92–108			Shaly clay and sandy clay loam.		
Dougherty: DoB	0–24	>60	A	Loamy fine sand	SM	A–2 or A–4
	24–100			Sandy clay loam	SC or CL	A–6
	100–124			Loamy fine sand	SM or SC	A–4 or A–2
Ellis: ElE	0–4	20–40	D	Clay	CH	A–7
	4–30			Clay	CH	A–7
	30–66			Shale and shaly clay.		
Engle: EnC	0–12	20–40	B	Clay loam	CL	A–6
	12–28			Clay loam	CL	A–6
	28–32			Sandstone.		
*Ferris: FeD2, FhE2, FlE	0–40	>60	D	Clay	CH	A–7
For Heiden part of FhE2 and FlE, see Heiden series.	40–66			Shaly clay.		
Freestone: FrA, FrB	0–18	>60	C	Fine sandy loam	SM or ML	A–4
	18–25			Sandy clay loam	SC or CL	A–6
	25–66			Clay loam	CL or CH	A–6 or A–7
	66–78			Sandy clay	CL or SC	A–7
	78–88			Sandy clay loam	SC or CL	A–6
Gowen: Gn, Go, Gw, Gy	0–48	>60	B	Clay loam	ML or CL	A–6
	48–62			Loam	ML or CL	A–4 or A–6

significant to engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for that characteristics are too variable for the material to be classified. <=less than; >=more than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	*In./hr.*	*In./in. of soil*	*pH*	
95–100	95–100	90–95	80–95	0. 63–2. 0	0. 15–0. 18	7. 9–8. 4	High.
95–100	95–100	85–95	80–95	0. 63–2. 0	0. 15–0. 18	7. 9–8. 4	Moderate.
95–100	95–100	85–95	75–80	0. 63–2. 0	0. 15–0. 18	7. 9–8. 4	Moderate.
95–100	85–100	75–85	35–55	0. 63–2. 0	0. 10–0. 12	4. 5–7. 3	Low.
94–100	85–100	80–100	50–75	<0. 06	0. 12–0. 16	4. 5–8. 4	High.
90–100	85–100	75–90	36–86	0. 63–2. 0	0. 10–0. 12	5. 6–8. 4	Low.
90–100	85–100	80–100	75–95	0. 2–0. 63	0. 12–0. 14	5. 6–7. 3	Moderate.
95–100	90–100	85–100	70–95	0. 06–0. 20	0. 12–0. 15	5. 6–7. 3	Moderate.
90–100	90–100	85–100	75–95	0. 2–0. 63	0. 12–0. 15	5. 6–7. 8	Moderate.
95–100	95–100	80–100	60–75	0. 63–2. 0	0. 12–0. 14	5. 6–7. 3	Low.
90–100	90–100	80–100	65–80	0. 20–0. 63	0. 12–0. 14	5. 6–6. 0	Moderate.
95–100	95–100	85–100	70–95	0. 06–0. 20	0. 12–0. 13	5. 1–8. 4	Moderate.
100	95–100	65–85	40–55	2. 0–6. 3	0. 11–0. 13	7. 9–8. 4	Low.
100	100	90–100	70–80	0. 63–2. 0	0. 12–0. 15	7. 9–8. 4	Moderate.
99–100	98–100	90–100	75–95	<0. 06	0. 15–0. 18	5. 6–8. 4	High.
95–100	95–100	85–95	70–95	<0. 06	0. 15–0. 18	5. 6–8. 4	High.
95–100	95–100	65–85	40–55	0. 63–2. 0	0. 10–0. 12	6. 1–6. 5	Low.
95–100	95–100	75–90	35–55	0. 63–2. 0	0. 12–0. 14	5. 1–6. 0	Moderate.
95–100	95–100	80–95	60–75	0. 63–2. 0	0. 12–0. 13	5. 6–7. 3	Moderate.
95–100	95–100	65–85	30–55	2. 0–6. 3	0. 13–0. 14	5. 1–6. 5	Low.
85–100	85–100	80–100	65–80	<0. 06	0. 14–0. 18	5. 6–8. 4	High.
95–100	95–100	90–100	65–100	<0. 06	0. 10–0. 13	6. 1–8. 4	Low.
100	100	50–75	30–50	2. 0–6. 3	0. 06–0. 08	6. 1–6. 5	Low.
100	100	90–100	35–55	0. 63–2. 0	0. 12–0. 16	5. 1–6. 5	Low.
100	100	45–75	30–50	2. 0–6. 3	0. 06–0. 09	4. 5–5. 0	Low.
95–100	95–100	85–100	70–95	< 0. 06	0. 12–0. 15	6. 6–7. 3	High.
95–100	95–100	85–100	70–95	< 0. 06	< 0. 05	6. 6–7. 8	High.
95–100	90–100	80–100	65–80	0. 63–2. 0	0. 11–0. 14	7. 9–8. 4	Moderate.
90–100	85–100	75–100	60–80	0. 63–2. 0	0. 10–0. 12	7. 9–8. 4	Moderate.
95–100	95–100	79–100	70–95	< 0. 06	0. 15–0. 18	7. 9–8. 4	High.
100	100	70–85	40–55	0. 63–2. 0	0. 12–0. 15	5. 1–6. 5	Low.
100	95–100	75–90	45–55	0. 20–0. 63	0. 13–0. 15	4. 5–6. 5	Moderate.
95–100	85–100	80–95	60–80	0. 06–0. 20	0. 14–0. 15	5. 6–7. 3	Moderate.
100	100	85–95	45–60	0. 06–0. 20	0. 10–0. 15	7. 9–8. 4	Moderate.
100	95–100	75–90	45–55	0. 63–2. 0	0. 10–0. 14	7. 9–8. 4	Moderate.
100	95–100	85–95	65–80	0. 63–2. 0	0. 18–0. 20	5. 6–6. 5	Low.
100	95–100	80–95	55–75	0. 63–2. 0	0. 18–0. 20	5. 6–6. 5	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth from surface	Depth to bedrock	Hydrologic group	Classification		
				Dominant USDA texture	Unified	AASHO
Heiden: HaB, HaC, HaC2, HaD, HaD2.	0–44 44–88	>60	D	Clay Shaly clay.	CH	A–7
Houston Black: HbA, HbB, HbC, HbC2, HbD.	0–90	>60	D	Clay	CH	A–7
Kaufman: Ka, Kc	0–62	>60	D	Clay	CH	A–7
Konawa: KoB, KoD, KoD2	0–10 10–45 45–61	>60	B	Fine sandy loam Sandy clay loam Loamy fine sand	SM SC or CL SM	A–4 A–6 A–4 or A–2
Lamar: LaD, LaE2	0–62	>60	B	Clay loam	CL	A–6
Lufkin: LuA	0–8 8–56 56–60	>60	D	Fine sandy loam Clay Silty clay	SM or ML CH CL or CH	A–4 A–7 A–7
Nimrod: NmA	0–22 22–64 64–86	>60	C	Loamy fine sand Sandy clay loam Sandy clay loam	SM SC SC	A–2 A–6 A–6 or A–2
Okemah: OkA	0–5 5–12 12–86	>60	C	Loam Clay loam Clay	ML or CL CL CH or CL	A–4 or A–6 A–6 A–7
Patilo: PaD	0–66 66–132 132–140	>60	C	Loamy fine sand Sandy clay loam Sandy loam	SM or SP–SM SC SM	A–2 A–6 A–2 or A–4
Pursley: Pr, Ps	0–40 40–60	>60	B	Clay loam and loam Silty clay loam	CL CL	A–6 A–7
Purves: PuC	0–18 18–20	8–20	D	Clay Limestone bedrock.	CH	A–7
Stidham: StC	0–35 35–60 60–72	>60	A	Loamy fine sand Sandy clay loam Sandy loam	SM SC or CL SM or ML	A–2 or A–4 A–6 A–2 or A–4
Tabor: TaA	0–15 15–48 48–66 66–80	>60	D	Fine sandy loam Clay Clay loam Loam	SM CH CH CL or CH	A–2 A–7 A–7 A–6 or A–7
Trinity: Tn, Tr	0–58	>60	D	Clay	CH	A–7
Tuckerman: Tu	0–30 30–60	>60	D	Loam and fine sandy loam Clay loam	ML, CL or SM CL or SC	A–4 A–6 or A–7
Venus: VeE	0–60	>60	B	Clay loam	CL	A–6
Wilson: WlA, WlB, WnA, WnB, WnC, WnC2.	0–8 8–48 48–60	>60	D	Clay loam Clay Clay	CL or ML–CL CL or CH CL or CH	A–4 or A–6 A–7 A–7

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	*In./hr.*	*In./in. of soil*	*pH*	
95–100	95–100	85–100	75–95	< 0. 06	0. 16–0. 18	7. 9–8. 4	High.
100	100	95–100	85–100	< 0. 06	0. 16–0. 18	7. 9–8. 4	High.
100	95–100	95–100	90–95	< 0. 06	0. 18–0. 20	5. 6–8. 4	High.
100	100	70–85	35–50	0. 63–2. 0	0. 10–0. 12	6. 1–6. 5	Low.
100	100	90–100	35–55	0. 63–2. 0	0. 10–0. 12	5. 1–5. 5	Low.
100	100	50–75	30–50	2. 0–6. 3	0. 08–0. 10	5. 1–5. 5	Low.
95–100	95–100	85–100	65–80	0. 63–2. 0	0. 13–0. 15	7. 9–8. 4	Moderate.
95–100	95–100	90–100	40–55	0. 63–2. 0	0. 12–0. 14	5. 1–6. 0	Low.
95–100	95–100	95–100	70–85	< 0. 06	0. 12–0. 16	5. 1–8. 4	High.
90–100	90–100	85–95	80–85	< 0. 06	0. 10–0. 13	7. 9–8. 4	Moderate.
100	100	90–100	15–20	2. 0–6. 3	0. 06–0. 08	5. 6–7. 3	Low.
100	95–100	70–100	35–50	0. 20–0. 63	0. 14–0. 18	4. 5–6. 0	Low.
95–100	90–100	90–100	30–50	0. 20–0. 63	0. 14–0. 18	5. 1–6. 0	Low.
95–100	95–100	80–95	55–75	0. 63–2. 0	0. 12–0. 14	5. 6–6. 0	Low.
95–100	95–100	85–100	65–80	0. 20–0. 63	0. 12–0. 14	5. 1–5. 5	Moderate.
95–100	95–100	85–100	70–95	0. 06–0. 20	0. 10–0. 13	5. 1–8. 4	Moderate.
100	100	90–100	15–20	6. 3–20. 0	0. 05–0. 07	6. 1–7. 3	Low.
98–100	95–100	70–100	35–50	0. 20–0. 63	0. 14–0. 18	5. 6–6. 0	Low.
100	100	60–70	30–40	2. 0–6. 3	0. 06–0. 07	5. 6–6. 0	Low.
100	95–100	90–100	80–95	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	Moderate.
100	95–100	90–100	80–95	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	Moderate.
80–95	70–95	65–95	55–90	0. 20–0. 63	0. 16–0. 18	7. 9–8. 4	High.
100	100	55–75	30–50	2. 0–6. 3	0. 06–0. 08	5. 6–7. 3	Low.
100	100	90–100	40–55	0. 63–2. 0	0. 10–0. 12	4. 5–5. 0	Low.
100	100	90–100	30–60	0. 63–2. 0	0. 10–0. 12	4. 5–5. 0	Low.
95–100	95–100	70–85	15–35	0. 63–2. 0	0. 10–0. 12	4. 5–7. 3	Low.
95–100	95–100	90–100	65–90	< 0. 06	0. 06–0. 08	5. 1–8. 4	High.
95–100	95–100	90–100	65–85	0. 06–0. 20	0. 06–0. 09	7. 4–7. 8	Moderate.
95–100	95–100	75–95	65–90	0. 06–0. 20	0. 08–0. 10	7. 4–7. 8	Moderate.
98–100	98–100	85–100	80–95	< 0. 06	0. 18–0. 20	7. 9–8. 4	High.
100	100	85–90	40–65	0. 63–2. 0	0. 13–0. 16	4. 5–5. 5	Low.
100	100	80–90	35–65	0. 06–0. 20	0. 15–0. 18	4. 5–6. 0	Moderate.
95–100	95–100	85–100	65–80	0. 63–2. 0	0. 18–0. 20	7. 9–8. 4	Moderate.
100	100	95–100	60–80	0. 20–0. 63	0. 15–0. 20	5. 6–7. 3	Low.
100	100	95–100	75–90	< 0. 06	0. 15–0. 20	6. 1–8. 4	High.
95–100	95–100	90–100	70–90	< 0. 06	0. 12–0. 15	7. 9–8. 4	High.

TABLE 4.—*Engineering interpretations*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that appear

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—			
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Altoga: AlC	Poor: silty clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Moderate: moderate permeability.	Moderate: slopes of 2 to 5 percent; moderate permeability.
Axtell: AxB, AxC, AxC2, AxE.	Fair where fine sandy loam is 6 to 12 inches thick; poor where it is 2 to 6 inches thick.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	None to slight if slopes are 1 to 2 percent; moderate if slopes are 2 to 7 percent; severe if slopes are 7 to 12 percent.
Bazette: BaF	Poor where silty clay loam is 3 to 6 inches thick; fair where it is 6 to 9 inches thick.	Poor: poor traffic-supporting capacity.	Poor: poor traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: slow permeability.	Moderate if slopes are 5 to 7 percent; severe if slopes are 7 to 20 percent.
Bonham: BmB	Poor where loam is 5 to 6 inches thick; fair where it is 6 to 12 inches thick.	Poor: poor traffic-supporting capacity.	Poor: poor traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: slow permeability.	None to slight
Bunyan: Bn	Good where loam is 20 to 26 inches thick; fair where it is 6 to 20 inches thick; poor where it is 4 to 6 inches thick.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.	Moderate: moderate permeability.
Burleson: BuA, BuB.	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slowly permeable.	None to slight if slopes are 0 to 2 percent; moderate if slopes are 2 to 3 percent.
Chickasha: ChD, CkD2.	Fair where fine sandy loam is 6 to 18 inches thick; poor where it is 4 to 6 inches thick.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Moderate where bedrock is at a depth of 48 to 60 inches; severe where it is at a depth of 40 to 48 inches; moderate permeability.	Moderate: moderate permeability; severe if slopes are 7 to 10 percent.

of the soils

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions in the first column of this table]

Degree of limitations and soil features affecting—Continued			Soil features affecting—			Corrosivity class and contributing soil features	
Farm ponds		Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Uncoated steel	Concrete
Reservoir areas	Embankments						
Moderate: moderate permeability.	Moderate: fair slope stability.	Well drained	Slopes	All features favorable.	All features favorable.	Moderate: resistivity.	Low.
None to slight	Moderate: fair slope stability.	Moderately well drained.	Very slow intake rate; slopes.	Clayey below surface layer; construction difficult.	Highly erodible.	High: clay texture.	Low.
None to slight	Moderate: fair slope stability.	Well drained	Slopes	Irregular slopes; construction difficult.	Slopes; erodible.	Moderate: silty clay loam texture.	Low.
None to slight	Moderate: fair slope stability.	Moderately well drained.	Slow intake rate.	All features favorable.	All features favorable.	High: clay texture.	Low.
Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Well drained	Moderate intake rate; subject to flooding.	Subject to flooding.	Subject to flooding.	Moderate: clay loam texture.	Low.
None to slight	Moderate: fair slope stability.	Very slow permeability; areas of surface ponding.	Very slow intake rate.	All features favorable.	All features favorable.	High: clay loam texture.	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Well drained	Slopes; erosion hazard.	Slopes	Erosion hazard; sloping relief.	Low	Low.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—			
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Crockett: CrA, CrB, CrC, CrD, CtC2, CtD3.	Fair where fine sandy loam is 6 to 15 inches thick; poor where it is 3 to 6 inches thick.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight if slopes are 0 to 2 percent; moderate if slopes are 2 to 7 percent; severe if slopes are 7 to 8 percent.
Dougherty: DoB	Poor: loamy fine sand.	Good	None to slight	None to slight	None to slight	Severe: seepage
Ellis: ElE	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell; poor traffic-supporting capacity.	Severe: high shrink-swell; poor traffic-potential.	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are 7 to 10 percent.
Engle: EnC	Fair: clay loam texture.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Severe where bedrock is at a depth of 20 to 36 inches; moderate where it is at a depth of 36 to 40 inches; moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
*Ferris: FeD2, FhE2, FlE. For Heiden part of FhE2 and FlE, see Heiden series.	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Severe if slopes are 7 to 15 percent; moderate if slopes are 3 to 7 percent.
Freestone: FrA, FrB.	Fair where fine sandy loam is 6 to 20 inches thick.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: slow permeability.	None to slight if slopes are 0 to 2 percent; moderate if slopes are 2 to 3 percent.
Gowen: Gn, Go, Gw, Gy.	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Severe: flood hazard.	Severe: flood hazard.	Severe: flood hazard.	Moderate: moderate permeability.
Heiden: HaB, HaC, HaC2, HaD, HaD2.	Poor: clay texture.	Poor: high shrink-swell potential; highly plastic.	Severe: high shrink-swell potential; highly plastic.	Severe: high shrink-swell potential.	Severe: very slow permeability.	None to slight if slopes are 1 to 2 percent; moderate if slopes are 2 to 7 percent; severe if slopes are 7 to 15 percent.

of the soils—Continued

Degree of limitations and soil features affecting—Continued			Soil features affecting—			Corrosivity class and contributing soil features	
Farm ponds		Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Uncoated steel	Concrete
Reservoir areas	Embankments						
None to slight	Moderate: fair slope stability.	Moderately well drained.	Very slow intake rate; erosion hazard on steeper slopes.	Clayey below surface layer; construction difficult.	Cuts may expose clayey material; difficult to establish vegetation in eroded areas.	High: clay texture.	Low.
Severe: seepage	Moderate: fair slope stability.	Well drained	Rapid initial intake rate; low available water capacity.	Poor stability; upper 20 to 36 inches loamy fine sand.	Siltation problem from soil blowing.	Moderate: sandy clay loam texture.	Moderate: slightly to strongly acid.
None to slight	Moderate: fair slope stability.	Well drained to somewhat excessively drained.	Slopes very slow intake rate; erosion hazard.	Slopes	Slopes; cuts may expose clayey material.	High: clay texture.	Low.
Severe where bedrock is at a depth of 20 to 36 inches; moderate where it is at a depth of 36 to 40 inches; moderately permeable.	Severe where bedrock is at a depth of 20 to 24 inches; moderate where it is at a depth of 24 to 40 inches; fair resistance to piping and erosion.	Well drained	Bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches.	Moderate: clay loam texture.	Low.
None to slight	Moderate: fair slope stability.	Somewhat excessively drained.	Very slow intake rate; slopes; erosion hazard.	Slopes; construction difficult.	Slopes; difficult to establish vegetation in cuts.	High; clay texture.	Low.
None to slight	Moderate: fair resistance to piping and erosion.	Moderately well drained to somewhat poorly drained.	All features favorable.	All features favorable.	All features favorable.	High: somewhat poorly drained; clay loam texture.	Low.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Subject to flooding.	Subject to flooding.	Subject to flooding; siltation of channels.	Subject to flooding; siltation hazard.	Moderate: clay loam texture.	Low.
None to slight	Moderate: fair slope stability.	Well drained	Very slow intake rate; erosion hazard; slopes.	Construction difficult on steeper slopes.	Difficult to establish vegetation on steeper slopes.	High: clay texture.	Low.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—			
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Houston Black: HbA, HbB, HbC, HbC2, HbD.	Poor: clay texture.	Poor: highly plastic; high shrink-swell potential.	Severe: highly plastic; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	None to slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 7 percent; severe where slopes are 7 to 8 percent.
Kaufman: Ka, Kc	Poor: clay texture.	Poor: highly plastic; high shrink-swell potential.	Severe: highly plastic; high shrink-swell potential; subject to flooding.	Severe: high shrink-swell potential; subject to flooding.	Severe: very slow permeability.	None to slight
Konawa: KoB, KoD, KoD2.	Fair where fine sandy loam is 6 to 18 inches thick; poor where it is 3 to 6 inches thick.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; slopes are 6 to 8 percent.	Moderate: where slopes are 6 to 8 percent; none to slight where slopes are 1 to 6 percent.	None to slight where slopes are 1 to 5 percent; moderate where slopes are 5 to 8 percent.	Severe: seepage
Lamar: LaD, LaE2	Fair: clay loam texture.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic supporting capacity.	Moderate: moderate shrink-swell potential.	Moderate where slopes are 5 to 10 percent; moderate permeability.	Severe where slopes are 10 to 12 percent; moderate where slopes are 5 to 10 percent; moderate permeability.
Lufkin: LuA	Poor where fine sandy loam is 4 to 6 inches thick; fair where it is 6 to 13 inches thick.	Poor: highly plastic; high shrink-swell potential.	Severe: highly plastic; high shrink-swell potential; poorly drained.	Severe: high shrink-swell potential; somewhat poorly drained to poorly drained.	Severe: very slow permeability.	None to slight
Nimrod: NmA	Fair: loamy fine sand texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	None to slight	Severe: moderately slow permeability.	Moderate: moderately slow permeability.
Okemah: OkA	Poor where loam is 4 to 6 inches thick; fair where it is 6 to 8 inches thick.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: slow permeability.	None to slight
Patilo: PaD	Poor: loamy fine sand texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	None to slight	None to slight if slopes are 1 to 5 percent; moderate if slopes are 5 to 8 percent.	Severe if slopes are 7 to 8 percent; moderate if slopes are 2 to 7 percent.

of the soils—Continued

Degree of limitations and soil features affecting—Continued			Soil features affecting—			Corrosivity class and contributing soil features	
Farm ponds		Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Uncoated steel	Concrete
Reservoir areas	Embankments						
None to slight	Moderate: fair slope stability.	Moderately well drained.	Very slow intake rate; erosion hazard.	Construction difficult on steeper slopes.	Difficult to establish vegetation on steeper slopes.	High: resistivity.	Low.
None to slight	Moderate: fair slope stability.	Somewhat poorly drained; subject to flooding.	Very slow intake rate; subject to flooding.	Subject to flooding; siltation of channels.	Subject to flooding; siltation hazard.	High: clay texture.	Low.
Severe: seepage	Moderate: fair slope stability.	Well drained	Erosion hazard on steeper slopes.	Construction difficult on steeper slopes.	Difficult to establish vegetation on steeper slopes.	Low	Moderate: strongly acid.
Moderate: moderate permeability.	Moderate: fair slope stability.	Well drained	Slopes; erosion hazard.	Slopes	Slopes; highly erodible; difficult to establish vegetation.	Moderate: clay loam texture.	Low.
None to slight	Moderate: fair slope stability.	Somewhat poorly drained to poorly drained.	Very slow intake rate.	Clayey below surface layer; construction difficult.	Cuts may expose highly clayey material; difficult to establish vegetation.	High: clay texture.	Low.
Moderate: moderately slow permeability.	Moderate: fair slope stability.	Moderately well drained.	High initial intake rate.	Poor stability; sandy surface.	Siltation due to blowing soil.	Moderate: sandy clay loam texture.	Low.
None to slight	Moderate: fair slope stability.	Moderately well drained.	Slow intake rate.	All features favorable.	All features favorable.	High: clay texture.	Low.
Severe seepage	Moderate: fair resistance to piping and erosion.	Moderately well drained.	Rapid intake rate, slopes.	Unstable; sandy soils; slopes.	Sandy soils; erosion hazard.	Low	Low.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—			
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Pursley: Pr, Ps	Fair: clay loam texture.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Severe: subject to flooding.	Severe: flood hazard.	Moderate: moderate permeability.
Purves: PuC	Poor: clay texture.	Poor: bedrock at a depth of 8 to 20 inches.	Severe: bedrock at a depth of 8 to 20 inches.	Severe: bedrock at a depth of 8 to 20 inches; high shrink-swell potential.	Severe: bedrock at a depth of 8 to 20 inches.	Severe: bedrock at a depth of 8 to 20 inches.
Stidham: StC	Poor: loamy fine sand texture.	Good	None to slight	None to slight	None to slight	Severe: seepage
Tabor: TaA	Fair where fine sandy loam is 10 to 20 inches thick.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	None to slight
Trinity: Tn, Tr	Poor: clay texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity; flooding hazard.	Severe: high shrink-swell potential; subject to flooding.	Severe: subject to flooding; very slow permeability.	None to slight
Tuckerman: Tu	Poor: poorly drained.	Poor: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: slow permeability.	None to slight
Venus: VeE	Fair: clay loam texture.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: if slopes are 10 to 15 percent; moderate if slopes are 5 to 10 percent; moderately permeable.	Severe: if slopes are 7 to 15 percent; moderate if slopes are 5 to 7 percent; moderately permeable.
Wilson: WlA, WlB, WnA, WnB, WnC, WnC2.	Fair: clay loam texture.	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high plasticity; high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: very slow permeability.	None to slight if slopes are 0 to 2 percent; moderate if slopes are 2 to 5 percent.

of the soils—Continued

Degree of limitations and soil features affecting—Continued			Soil features affecting—			Corrosivity class and contributing soil features	
Farm ponds		Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Uncoated steel	Concrete
Reservoir areas	Embankments						
Moderate; moderate permeability	Moderate: fair resistance to piping and erosion.	Well drained; subject to flooding.	Subject to flooding.	Subject to flooding; siltation of channels.	Subject to flooding, siltation hazard.	Moderate: clay loam texture.	Low.
Severe: bedrock at a depth of 8 to 20 inches.	Severe: bedrock at a depth of 8 to 20 inches.	Well drained	Bedrock at a depth of 8 to 20 inches.	Bedrock at a depth of 8 to 20 inches.	Bedrock at a depth of 8 to 20 inches.	High: clay texture.	Low.
Severe: seepage	Moderate: fair slope stability.	Well drained	Rapid intake rate.	Poor stability; sandy surface.	Siltation; vegetation difficult to establish because of slope.	Low	High: very strongly acid.
None to slight	Moderate: fair slope stability.	Somewhat poorly drained.	Very slow intake rate.	All features favorable.	All features favorable.	High: clay texture.	Low.
None to slight	Moderate: fair slope stability.	Subject to flooding; moderately well drained to somewhat poorly drained.	Very slow intake rate; subject to flooding.	Subject to flooding; siltation of channels.	Subject to flooding; siltation hazard.	High: clay texture.	Low.
None to slight	Moderate: fair resistance to piping and erosion.	Depressions; poorly drained.	Depressions; poorly drained.	Depressions; no outlets.	Depressions; difficult to establish vegetation because of wetness.	High: poorly drained; clay loam texture.	High: very strongly acid.
Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Well drained	Slopes; erosion hazard.	Sloping relief.	Slopes	Moderate: clay loam texture.	Low.
None to slight	Moderate: fair slope stability	Somewhat poorly drained.	Very slow intake rate.	Clayey below surface layer; construction difficult.	Cuts may expose clayey material; difficult to establish vegetation.	High: clay texture.	Low.

TABLE 5.—*Engineering*

[Tests performed by Texas Highway Department Testing Laboratory in accordance with

Soil name and location	Parent material	Texas report No.	Depth	Shrinkage		
				Limit	Linear	Ratio
			In.	*Pct.*	*Pct.*	*Pct.*
Axtell fine sandy loam: 5 miles southeast of Kerens and 1.1 miles southeast of Goodnight. (Modal)	Moderate alkaline, noncalcareous sandy clay loam.	64-488-R 64-489-R	10-33 72-88	13 14	16. 6 18. 8	1. 92 1. 88
Crockett fine sandy loam: 4 miles east of Kerens and 0.8 mile north of Goodnight. (Modal)	Alkaline, noncalcareous shaly clay.	64-484-R 64-485-R	5-26 54-84	12 16	18. 2 20. 3	1. 97 1. 79
Ferris clay: 2 miles north of Blooming Grove. (Modal)	Calcareous clay over shaly clay.	64-496-R 64-497-R	7-19 41-85	11 12	19. 6 20. 0	1. 95 1. 93
Heiden clay: 2.8 miles northeast of Blooming Grove. (Modal)	Calcareous clay over shaly clay.	64-498-R 64-499-R	6-18 44-88	11 13	19. 7 19. 5	2. 00 1. 93
Houston Black clay: 0.8 mile southeast of Barry. (Modal)	Calcareous clay.	64-490-R 64-491-R	7-17 40-90	12 11	26. 0 26. 2	1. 91 1. 93
Tabor fine sandy loam: 4.2 miles east-southeast of Kerens and 0.6 mile northeast of Goodnight. (Modal)	Alkaline, noncalcareous clay.	64-486-R 64-487-R	20-36 70-84	10 15	18. 2 15. 6	2. 02 1. 85

[1] Mechanical analysis according to the AASHO Designation T88-57 (*1*). Results obtained by this procedure may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method

Town and County Planning

This section was prepared chiefly for planners, developers, landscape architects, builders, zoning officials, realtors, private and potential landowners, and others interested in use of the soils in Navarro County for purposes other than farming. The county is near Dallas, and its population is increasing because the suburbs are steadily expanding into areas formerly used for farming. In particular, the demand for outdoor recreational facilities is increasing.

Many people enjoy boating, water skiing, fishing, swimming, and picnicking on and around the Navarro Mills Reservoir and other water areas in the county. Also, some landowners in the county have developed areas around ponds, reservoirs, lakes, and structures for retarding flood water to provide facilities for hunting, fishing, and other recreational activities. The county has potential for further development of recreational facilities that would provide economic return to the landowner.

In table 6 the soils of the county are rated according to their suitability for specific recreational uses and the nature of the soil limitations that influenced the ratings are shown. The ratings are based on soil features only, and detailed inspection of the soils at the site is needed.

The ratings used are *none to slight*, *moderate*, *severe*, and *very severe*. If the rating is *none to slight*, little or no adjustments are needed in use or the limitation is not serious and is easy to overcome. A rating of *moderate* means that some adjustments are needed in use. A rating of *severe* means that extensive adjustments are needed before the soil is suitable for a specific purpose. A rating of *very severe* means that the limitations are so severe that use of the soil for the stated purpose is impractical.

Campsites are areas suitable for tent and camp trailer sites and the accompanying activities for outdoor living for periods of at least one week. The soils are not required to be suitable for septic tanks. The soils require little site preparation.

Paths and trails refer to the use of soils for trails, cross-country hiking, bridle paths, and uses which allow for the random movement of people. Most of the soils in the county have a moderate or severe limitation for use as a site for paths or trails. The dominant adverse soil feature is trafficability, which refers to the ease with which people can move about over the soil on foot, on horseback, or in small vehicles such as golf carts.

Playgrounds are areas developed for organized games such as baseball, football, badminton, and the like. They are subject to intensive foot traffic, and generally require a soil with nearly level surface, good drainage, and a texture and consistence that give a firm surface.

test data

standard procedures of the American Association of State Highway Officials (AASHO)(*1*)]

Mechanical analyses [1]								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—					Percent smaller than—						
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			Unified [2]	AASHO [3]
								Pct.			
98	94	89	86	64	61	47	44	50	29	CL	A–7–6 (15)
93	92	91	90	86	85	46	38	60	41	CH	A–7–6 (20)
90	89	88	86	68	66	46	42	53	34	CH	A–7–6 (17)
100	100	100	100	99	97	51	42	71	52	CH	A–7–6 (20)
100	99	97	79	74	70	44	36	59	38	CH	A–7–6 (20)
100	99	98	98	94	92	57	47	61	42	CH	A–7–6 (20)
100	100	99	98	93	84	54	44	57	38	CH	A–7–6 (19)
100	98	96	96	92	85	55	46	60	42	CH	A–7–6 (20)
100	100	100	100	98	97	70	62	89	62	CH	A–7–6 (20)
100	100	100	100	99	99	72	62	88	65	CH	A–7–6 (20)
100	99	98	92	74	70	44	41	51	32	CH	A–7–6 (18)
99	99	99	94	87	82	34	29	51	34	CH	A–7–6 (18)

and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soils.

[2] Based on the Unified Soil Classification System (*8*).

[3] Based on AASHO Designation M 145–49 (*1*).

Picnic areas are sites suitable for pleasure outings at which a meal is eaten outdoors. Properties important in evaluating soils for picnic areas are trafficability, flood hazard, and slope.

Formation and Classification of Soils

The purpose of this section is to present the outstanding morphologic characteristics of the soils of Navarro County and to relate them to the factors of soil formation. This section contains two main parts. First, the five major factors of soil formation and the processes involved in soil horizon differentiation are discussed briefly in terms of their effect on the soils of Navarro County. Second, the system of classifying soils is discussed and the soils are placed in the system.

Formation of Soils

Soils are natural bodies at the surface of the earth's crust having properties due to the integrated effects of *climate* and *plants and animals* as modified by *relief* acting on *parent material* over *time*. A change in the degree of expression of any of the five interrelated factors leads to the formation of different soils.

Climate.—The climate of Navarro County is humid subtropical and presumably has been unchanged over recent pedologic time. Rainfall averages 36.96 inches annually, which is fairly evenly distributed throughout the year, except for midsummer droughts. Most of the rainfall comes late in spring or early in summer, mainly as thundershowers. The temperature is hot in summer and mild in winter. The mild climate has promoted rapid soil development. Climate is uniform throughout the county, although its effect is modified locally by relief. Therefore, the differences in Navarro County soils are not primarily caused by climatic variations. Soils are continuing to undergo developmental changes.

Plants and animals.—Plants, animals, insects, bacteria, and fungi are important in the formation of soils. Gains or losses in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are among the changes caused by living organisms. Under the dominant grass vegetation, soils that are medium in organic-matter content have formed, but under the less prevalent hardwood trees, soils low in organic-matter content have formed. Man's use of the soil is having an influence on soil development. Overgrazing of grasslands and clearing of timberland have changed the kinds and amounts of plants, and these plants in time will further affect the character of the soils. Overgrazing and misuse of

TABLE 6.—*Degree of limitation for recreational development and the chief limiting properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Campsites	Paths and trails	Playgrounds	Picnic areas
Altoga: AlC	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.
Axtell: AxB, AxC, AxC2, AxE.	Severe: very slow permeability.	None to slight	Severe: very slow permeability.	None to slight for slopes of 1 to 8 percent; moderate for slopes of 8 to 12 percent.
Bazette: BaF	Moderate: silty clay loam texture; severe for slopes of 15 to 20 percent.	Moderate: silty clay loam texture; slopes of 15 to 20 percent.	Severe for slopes of 6 to 20 percent; moderate for slopes of 5 to 6 percent.	Moderate: for slopes of 5 to 15 percent; severe for slopes of 15 to 20 percent; silty clay loam texture.
Bonham: BmB	None to slight	None to slight	Moderate: slow permeability; slopes of 2 to 3 percent.	None to slight.
Bunyan: Bn	Moderate: moderate permeability.	None to slight	Moderate: flooding hazard.	None to slight.
Burleson: BuA, BuB	Severe: very slow permeability, clay texture.	Severe: clay texture	Severe: very slow permeability; clay texture.	Severe: clay texture.
Chickasha: ChD, CkD2	None to slight	None to slight	Moderate for slopes of 3 to 6 percent; severe for slopes of 6 to 10 percent.	None to slight for slopes of 3 to 8 percent; moderate for slopes of 8 to 10 percent.
Crockett: CrA, CrB, CrC, CrD, CtC2, CtD3.	Severe: very slow permeability.	None to slight	Severe: very slow permeability.	None to slight.
Dougherty: DoB	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.
Ellis: ElE	Severe: very slow permeability; clay texture.	Severe: clay texture	Severe: very slow permeability; clay texture.	Severe: clay texture.
Engle: EnC	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.
*Ferris: FeD2, FhE2, FlE. For Heiden part of FhE2 and FlE, see Heiden series.	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability; slopes of 6 to 15 percent.	Severe: clay texture.
Freestone: FrA, FrB	Moderate: slow permeability.	None to slight	Moderate: slow permeability.	None to slight.
Gowen: Gn, Go, Gw, Gy	Severe: flooding hazard.	Moderate: clay loam texture.	Moderate: flooding hazard; clay loam texture.	Moderate: flooding hazard; clay loam texture.
Heiden: HaB, HaC, HaC2, HaD, HaD2.	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability; slopes of 6 to 8 percent.	Severe: clay texture.
Houston Black: HbA, HbB, HbC, HbC2, HbD.	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability.	Severe: clay texture.
Kaufman: Ka, Kc	Severe: flooding hazard; clay texture.	Severe: clay texture	Severe: clay texture; flooding hazard.	Severe: clay texture.

TABLE 6.—*Degree of limitation for recreational development and the chief limiting properties*—Continued

Soil series and map symbols	Campsites	Paths and trails	Playgrounds	Picnic areas
Konawa: KoB, KoD, KoD2.	None to slight	None to slight	None to slight for slopes of 1 to 2 percent; moderate for slopes of 2 to 6 percent; severe for slopes of 6 to 8 percent.	None to slight.
Lamar: LaD, LaE2	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture; severe for slopes of 6 to 12 percent.	Moderate: clay loam texture.
Lufkin: LuA	Severe: somewhat poorly drained to poorly drained.	Severe: somewhat poorly drained to poorly drained.	Severe: somewhat poorly drained to poorly drained.	Severe: somewhat poorly drained to poorly drained.
Nimrod: NmA	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.
Okemah: OkA	Moderate: slow permeability.	None to slight	Moderate: slow permeability.	Moderate: moderately well drained.
Patilo: PaD	Severe: loamy fine sand texture.	Severe: loamy fine sand texture.	Severe: loamy fine sand texture.	Severe: loamy fine sand texture.
Pursley:				
Pr	Moderate: flooding hazard; clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.
Ps	Severe: flooding hazard	Moderate: clay loam texture.	Moderate: flooding hazard; clay loam texture.	Moderate: flooding hazard; clay loam texture.
Purves: PuC	Severe: clay texture	Severe: clay texture	Severe: clay texture	Severe: clay texture.
Stidham: StC	Severe: loamy fine sand texture.	Severe: loamy fine sand texture.	Severe: loamy fine sand texture.	Severe: loamy fine sand texture.
Tabor: TaA	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.
Trinity: Tn, Tr	Severe: subject to flooding; clay texture; very slow permeability.	Severe: clay texture	Severe: subject to flooding; clay texture; very slow permeability.	Severe: clay texture.
Tuckerman: Tu	Severe: poorly drained	Severe: poorly drained	Severe: poorly drained	Severe: poorly drained.
Venus: VeE	Moderate: clay loam texture.	Moderate: clay loam texture.	Severe for slopes of 6 to 15 percent; moderate for slopes of 5 to 6 percent; clay loam texture.	Moderate: clay loam texture.
Wilson: WlA, WlB, WnA, WnB, WnC, WnC2.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; clay loam texture.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; clay loam texture.

cultivated soils lead to soil compaction, higher runoff rates, and soil erosion. The amount of water and air that enters the soil is greatly reduced as a result of destruction of soil structure and less pore space. Bacterial action is greatly reduced.

Parent material.—Parent material is the consolidated and unconsolidated materials from which a soil is formed. It determines the limits of chemical and mineralogical composition of the soils.

The soils in Navarro County formed in five kinds of parent materials. They are: (1) clay and marl; (2) limestone caps over clay; (3) clay and shale; (4) sandy clays to clayey sediment, or old alluvium; and (5) recent alluvium.

Navarro County is underlain by 10 geologic formations in four groups (*3*). These formations are, from west to east across the county, Taylor clay or marl, Wolf City sand, and Pecan Gap chalk in the Taylor Group; Neylandville marl, Nacatoch sand, Corsicana marl, and Kemp clay

of the Navarro Group; Kincaid sands and clays, and Wills Point clay of the Midway Group; and the Wilcox Group.

Soils formed in clay and marl are from the Taylor clay or marl, Wolf City sand, Pecan Gap chalk, Neylandville marl, Nacatoch sand, Corsicana marl, and the Wills Point clay. The Taylor formations consist of black to very dark gray clay over blue to gray clayey shale, and the soils formed are Heiden, Houston Black, and Wilson soils. The Wolf City, Pecan Gap, Nacatoch, and Corsicana formations are interbedded sandy marl and clay, and the soils formed consist of Axtell, Chickasha, Crockett, Heiden, Houston Black, Lamar, and Wilson soils.

Soils formed in limestone caps over clays are from the Kincaid formation. This formation consists of a thin lintel of coquina, consisting of minute shells and shell fragments cemented together over clays and sands. It suggests shallow water where animal life was very abundant and shells were broken and rolled by the waves. Soils formed in the Kincaid formation are Venus and Lamar soils on steep slopes and Purves, Engle, Heiden, Houston Black, Burleson, Wilson, and Crockett soils on gentle slopes.

Soils formed in clay and shale are in the Neylandville and Kemp formations. These formations consist of gray to olive clayey shale or marl that produced such soils as the Burleson, Heiden, Houston Black, Wilson, and Crockett soils.

Soils formed in sandy clays to clayey sediment or old alluvium range from clayey to silty and sandy in texture. The finer textured old alluvium material was deposited by slow-moving water, and has a smooth relief. The Burleson and Wilson soils formed in this material. The sandier material was deposited by faster moving waters. Soils that formed in the sandier material are the Dougherty, Patilo, Frecstone, Konawa, Nimrod, and Stidham soils. These soils are nearly level to sloping.

Soils formed in recent alluvium are the Gowen, Kaufman, Pursley, Trinity, and Bunyan soils. They occupy flood plains of streams throughout the county. The texture of this alluvial material depends on the rate of water movement, and the texture of the soils in the watershed. A characteristic of most recent alluvial soils is that stratified layers of different textured material occur throughout the profile. Alluvial soils on some of the lower flood plains are subject to overflow and deposition of fresh alluvial sediment.

Relief.—Relief affects soil formation through modification of climatic and vegetative considerations by drainage, erosion, plant cover, and soil temperature. The relief of Navarro County ranges from nearly level to moderately steep.

Nearly level to gently sloping soils are deeper and have horizons that are more distinct than sloping to moderately steep soils and soils on ridges. The lower lying soils receive extra water, have less runoff, and are subject to less erosion.

On the steeper soils geological erosion occurs almost as fast as the soils are formed. An example is the moderately deep Bazette soils, which have been in the process of soil development as long as the generally less sloping, deep Crockett and Wilson soils.

Time.—Generally a long time is required for the formation of soils that have distinct horizons. The length of time that parent materials have been in place, therefore, commonly is reflected in the degree of development of the soil profile.

Young soils in Navarro County formed in recent alluvium, and old soils formed in some upland positions. The young soils have very little profile development, and the old soils have well-expressed soil horizons. Bunyan soils are an example of young soils that lack development. Except for slight accumulation of organic matter and darkening of their surface layer, Bunyan soils retain most of the characteristics of their recent alluvial sediment. Axtell soils are examples of older soils that have developed soil horizons. They developed distinct A and Bt horizons that bear little resemblance to the original parent material. The clay soils in the county are young in terms of horizon development, even though they may be old in terms of chronologic age. Horizon development in soils is not related to passage of time alone.

Processes of Horizon Differentiation

Several processes were involved in the formation of soil horizons in the soils of Navarro County. Three main processes are: (1) accumulation of organic matter; (2) leaching of calcium carbonates and bases; and (3) formation and translocation of silicate clay materials. In most soils more than one of these processes has been active in the development of horizons.

Accumulation of organic matter in the upper part of the profile to form an A1 horizon has been important. The soils of Navarro County range from medium to low in organic-matter content.

Leaching of carbonates and bases has occurred in many of the soils. Soil scientists generally are agreed that leaching of bases in soils generally precedes translocation of clay minerals. Many of the soils of the county are moderately leached, which has contributed to the development of horizons. Calcium carbonates have been leached from the upper horizons of most of the soils. The amount of rainfall, however, has not been great enough to leach the carbonates entirely from the soil, and some of the soils have a layer in which calcium carbonates have accumulated.

In several soils of Navarro County, the downward translocation of clay minerals has contributed to horizon development. The Bt horizon contains appreciably more silicate clay than the A horizon. These soils were probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clay took place. Leaching of bases and translocation of silicate clay are among the more important processes in horizon differentiation in the soils of Navarro County. The Axtell, Bonham, Crockett, and Wilson soils are examples of soils that have translocated silicate clay accumulated in the Bt horizon.

In Houston Black clay and in other soils that are calcareous at the surface profile, little or no development of horizons beyond the development of an A horizon has occurred. These soils undergo natural mixing, associated with crack formation and crack filling, which retards leaching of carbonates and development of horizons. Burleson and other clay soils are noncalcareous at the surface, but mixing has prevented formation of a B horizon.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us

to assemble knowledge about soils; to see their relationship to one another and to the whole environment; and to develop principles that help us to understand their behavior and response to various kinds of treatment. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge in managing farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*5*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (*4*) and was adopted in 1965 (*7*). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria for classification are soil properties that are observable and measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 7 shows the classification of each soil series of Navarro County by family, subgroup, and order, according to the current system.

General Nature of the County

Navarro County was named in honor of Jose Antonio Navarro, who played a prominent part in the struggle with Mexico. As a member of the Congress of the Republic of Texas, Navarro gave outstanding assistance to the committee selected to form the county. His work with this committee led to the county receiving his name. Born on the island of Corsica, his father came to America and settled in what is now San Antonio. The county seat, Corsicana, was named after the native land of Jose Antonio Navarro's father. Navarro County was created and organized in 1846 from Robertson County, and 10 counties were later formed from the original Navarro County.

The population of Navarro County in 1960 was 34,423, and in 1967, it was estimated to be 36,161. The population of Corsicana was 20,914 in 1960.

Transportation facilities in Navarro County are adequate. The county is served by three railroads: Rock Island, Southern Pacific, and St. Louis and Southwestern. U.S. Highway 75 (Interstate 45) and U.S. Highway 287 cross the county. Four State Highways are in the county, three of them for only a short distance: Highway 14 south of Richland, Highway 309 south of Kerens, and Highway 22 from Corsicana west through Frost. State Highway 31 crosses the center of the county through Dawson, Corsicana, and Kerens. In addition, about 25 Farm-to-Market Roads are in the county. Many county roads

TABLE 7.—*Classification of soil series*

Series	Family	Subgroup	Order
Altoga	Fine-silty, carbonatic, thermic	Typic Ustochrepts	Inceptisols.
Axtell	Fine, montmorillonitic, thermic	Udertic Paleustalfs	Alfisols.
Bazette	Fine, mixed, thermic	Udic Haplustalfs	Alfisols.
Bonham	Fine, mixed, thermic	Aquic Argiudolls	Mollisols.
Bunyan; calcareous variant	Fine-loamy, mixed, (calcareous), thermic	Typic Udifluvents	Entisols.
Burleson	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Chickasha [1]	Fine-loamy, mixed, thermic	Udic Argiustolls	Mollisols.
Crockett	Fine, montmorillonitic, thermic	Udertic Paleustalfs	Alfisols.
Dougherty	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols.
Ellis	Fine, mixed, thermic	Vertic Ustochrepts	Inceptisols.
Engle	Fine-loamy, mixed, thermic	Typic Calciustolls	Mollisols.
Ferris	Fine, montmorillonitic, thermic	Udorthentic Chromusterts	Vertisols.
Freestone	Fine-loamy, siliceous, thermic	Glossaquic Paleudalfs	Alfisols.
Gowen	Fine-loamy, mixed, thermic	Cumulic Hapludolls	Mollisols.
Heiden	Fine, montmorillonitic, thermic	Udic Chromusterts	Vertisols.
Houston Black	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Kaufman	Fine, montmorillonitic, thermic	Vertic Haplaquolls	Mollisols.
Konawa	Fine-loamy, mixed, thermic	Ultic Haplustalfs	Alfisols.
Lamar [2]	Fine-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Lufkin	Fine, montmorillonitic, thermic	Vertic Albaqualfs	Alfisols
Nimrod	Loamy, siliceous, thermic	Aquic Arenic Paleustalfs	Alfisols.
Okemah	Fine, mixed, thermic	Aquic Paleudolls	Mollisols.
Patilo	Loamy, siliceous, thermic	Grossarenic Paleustalfs	Alfisols.
Pursley	Fine-loamy, mixed, thermic	Fluventic Hapludolls	Mollisols.
Purves	Clayey, montmorillonitic, thermic	Lithic Calciustolls	Mollisols.
Stidham	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols.
Tabor	Fine, montmorillonitic, thermic	Aquic Paleustalfs	Alfisols.
Trinity	Fine, montmorillonitic, (calcareous), thermic	Vertic Haplaquolls	Mollisols.
Tuckerman	Fine-loamy, mixed, thermic	Typic Ochraqualfs	Alfisols.
Venus	Fine-loamy, mixed, thermic	Typic Calciustolls	Mollisols.
Wilson	Fine, montmorillonitic, thermic	Vertic Ochraqualfs	Alfisols.

[1] Chickasha soils, 5 to 10 percent slopes, eroded (*ChD2*) are outside the defined range of the series because they lack mollic epipedons; they are considered taxadjuncts to the series.

[2] About 69 percent of Lamar clay loam, 3 to 8 percent slopes (*LaD*) is noncalcareous in the upper 15 to 20 inches and is considered a taxadjunct to the series.

are graveled and are passable during bad weather, but many are impassible, though they present a well-distributed network of roads throughout the county.

The relief of Navarro County is mainly gently sloping, but it ranges from nearly level to moderately steep. Elevation ranges from about 250 feet on the flood plains of the Trinity River in the southeastern corner of the county to 564 feet in the southern part of the county about 1.35 miles west of the corner of Navarro, Freestone, and Limestone Counties, and 0.4 mile north of the Limestone County line.

The county is dissected by numerous well-defined drainage patterns and is well drained. The slope generally is toward the southeast. The Trinity River forms the eastern boundary of the county. All of Navarro County is in the Trinity River watershed, but Grays and Rush Creeks are the only main drainageways that empty into the Trinity River within the county. Chambers Creek and Richland Creek are the largest creeks in the county. Chambers Creek flows into Richland Creek in the southeastern part of the county. Richland Creek flows into the Trinity River in the northeastern part of Freestone County.

Climate [6]

The climate of Navarro County is humid subtropical with hot summers. Rainfall averages 36.96 inches annually. Rain is evenly distributed throughout the year, except for a midsummer minimum. Tropical maritime air masses almost completely dominate the area from early in May to late in September, and these air masses have a strong influence on the weather during other months. Prevailing winds are southerly during all months of the year, although northerly winds are frequent from November through February.

Winter temperatures are mild. The daily maximum temperature fails to rise above freezing only on an average of two days during each year. Arctic or unusually cold polar air masses plunging rapidly southward out of Canada bring sharp drops in temperature. When these cold air masses stagnate and are overrun by moist air from the south, several days of cold, cloudy, rainy weather follow. Generally, these occasional cold spells are of short duration with rapid clearing following cold frontal passages. The lowest temperature on record at Corsicana (since 1891) is −7° F. observed on February 12, 1899.

Daytime temperatures are hot in summer, particularly in July and August. Summer minimums are in the low 70's. Except for occasional thundershowers that dissipate the afternoon heat, little variation exists in the day-to-day weather in summer. The highest temperature on record at Corsicana is 113° F. observed in July 1893, and again on July 26, 1954.

The moderate temperature in spring and in fall is characterized by long periods of sunny skies, mild days, and cool nights.

Precipitation falls mostly as thundershowers. Rainfall is heaviest late in spring and early in summer, resulting from the interaction of polar air masses with the warm, moisture-laden tropical air from the Gulf of Mexico. High-intensity rains of short duration are likely to pro-

[6] By Robert B. Orton, climatologist for Texas, National Weather Service, U.S. Dept. of Commerce.

TABLE 8.—*Temperature and precipitation*

[Data from records kept at Corsicana, Texas, elevation 425 feet;

Month	Temperature				Precipitation			
					Average Total	Probability of receiving selected amounts during month		
	Average daily maximum	Average maximum	Average daily minimum	Average minimum		0 or trace	0.50 inch or more	1.00 inch or more
	°F.	°F.	°F.	°F.	In.	Pct.	Pct.	Pct.
January	56.6	77	34.7	17	2.75	<1	93	85
February	60.6	78	38.4	23	2.97	<1	97	90
March	68.1	84	43.9	28	2.76	<1	95	85
April	76.7	88	54.2	38	4.70	<1	98	93
May	83.8	93	62.7	50	4.83	<1	99	95
June	91.3	98	70.0	61	3.40	5	89	80
July	96.4	103	73.2	68	1.85	<1	85	70
August	97.3	105	72.6	66	2.23	1	80	65
September	91.0	100	66.1	53	2.54	1	88	76
October	82.0	93	55.4	40	3.01	1	85	85
November	69.1	85	43.5	28	3.08	<1	90	76
December	60.2	78	37.3	22	2.84	<1	95	85
Year	77.8	----------	54.3	----------	36.96	----------	----------	----------

[1] Average period of record is 11 years. [2] Less than half a day. [3] Trace.

duce rapid runoff almost anytime during the year. The predominantly anticyclonic atmospheric circulation over Texas in summer and the exclusion of cold fronts from North Central Texas result in a decrease in rainfall during midsummer. The amount of rain that falls varies considerably from month to month and from year to year. The wettest year of record at Corsicana (since 1886) was in 1957, when heavy spring and fall rains amounted to a total of 61.50 inches. Only 19.36 inches fell in 1917, the driest year on record.

Snowfall averages 2.1 inches annually; however, average values are misleading. After a snowfall of 4 or 5 inches, little or no snow is likely to fall for several years. Ice storms occur about as frequently as snowfall, and they do considerable damage to trees, shrubs, and utility lines. They do make travel hazardous for a few hours.

The warm season (freeze-free period) in Navarro County averages 253 days. The average date of the last freeze in the spring is March 10, and the average date of the first freeze in the fall is November 19. Low temperatures are very sensitive to variation in topography, air drainage, and wind; therefore, significant departures from the average values are likely to be found within the county.

Average annual relative humidity is about 82 percent at 6:00 a.m., 56 percent at noon, and 53 percent at 6:00 p.m., Central Standard Time. Seasonal averages vary only slightly. The area receives about 64 percent of the total possible sunshine annually. Mean annual lake evaporation is estimated at 55 inches.

Table 8 summarizes climatological data for Navarro County.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Satural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

data for Navarro County, Texas

mainly for the 30-year period from 1937–67. < =less than]

Precipitation—Continued										
Probability of receiving selected amounts during month—Continued					Mean number [1] of days			Snow, sleet		
2.00 inches or more	3.00 inches or more	4.00 inches or more	5.00 inches or more	6.00 inches or more	0.10 inch or more	0.50 inch or more	1.00 inch or more	Average total	Maximum	Greatest depth
Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*				*In.*	*In.*	*In.*
60	35	20	15	8	5	2	1	1.7	6.9	1
65	43	30	20	10	5	2	1	4	6.5	0
60	40	25	15	8	3	2	[2]	[2]	[2]	0
78	60	40	30	20	6	3	2	0	0	0
81	66	53	38	28	6	3	2	0	0	0
55	40	29	19	17	5	3	1	0	0	0
40	25	15	10	5	2	1	1	0	0	0
40	25	15	10	5	3	1	1	0	0	0
55	37	25	18	12	5	2	1	0	0	0
52	35	20	18	10	4	2	1	0	0	0
60	40	30	20	15	5	2	1	[2]	3.5	0
65	45	35	20	15	5	2	[2]	[2]	1.0	[2]
					54	25	12	2.1	6.9	1

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concave slope. A land surface that is curved like the interior of a sphere or arch.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Convex slope. A land surface that is curved like the exterior of sphere or arch.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water and air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy

parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

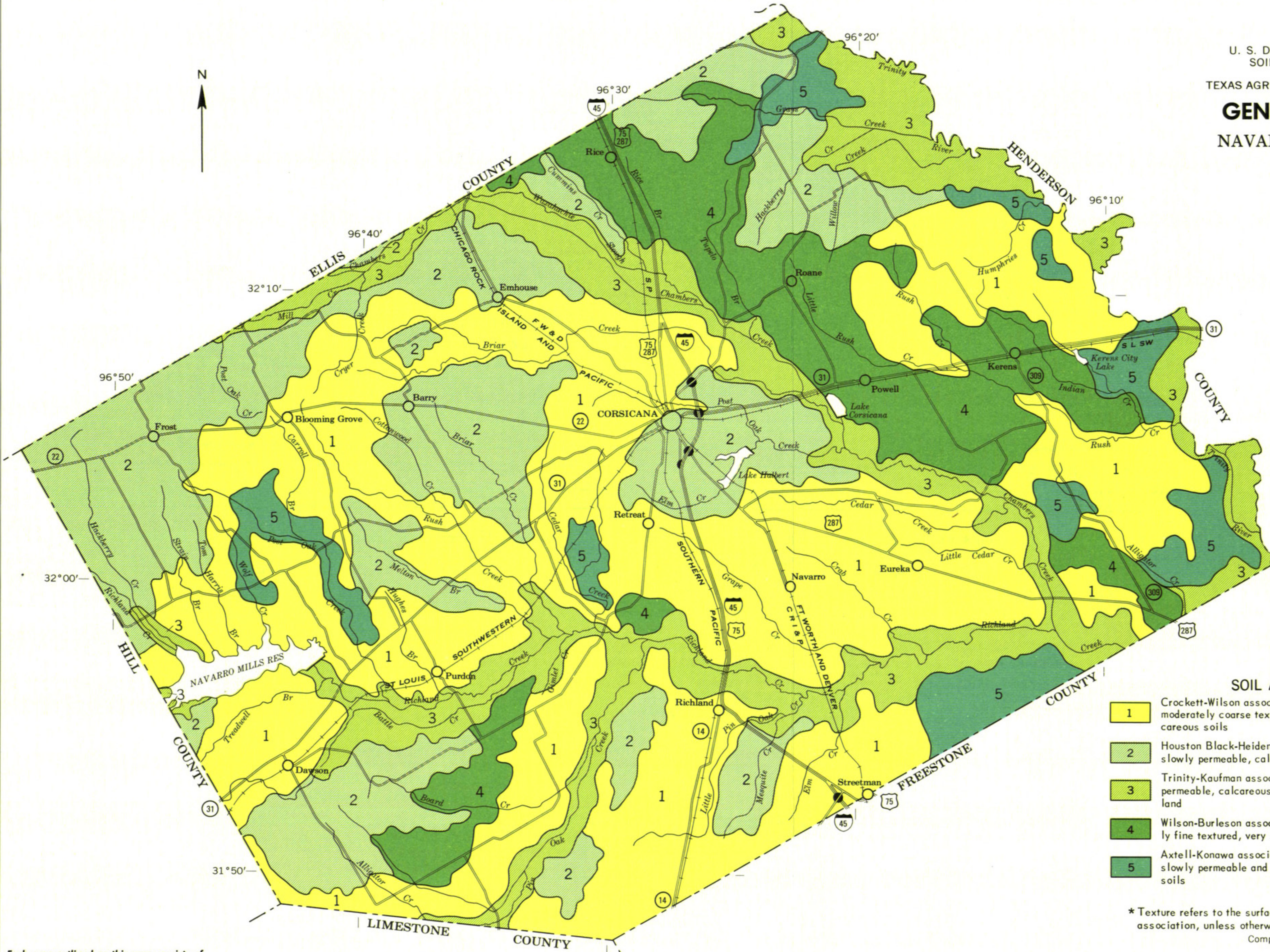
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

NAVARRO COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles



SOIL ASSOCIATIONS *

1	Crockett-Wilson association: Moderately fine textured and moderately coarse textured, very slowly permeable, noncalcareous soils
2	Houston Black-Heiden association: Fine-textured, very slowly permeable, calcareous soils
3	Trinity-Kaufman association: Fine-textured, very slowly permeable, calcareous and noncalcareous soils; on bottom land
4	Wilson-Burleson association: Fine textured and moderately fine textured, very slowly permeable, noncalcareous soils
5	Axtell-Konawa association: Moderately coarse textured, very slowly permeable and moderately permeable, noncalcareous soils

* Texture refers to the surface layer of the major soils in each association, unless otherwise stated.

Compiled 1972

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

NAVARRO COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

N

96°20′ 96°30′ 96°40′ 96°50′ 96°10′

32°10′ 32°00′ 31°50′

Inset, sheet 2 · Inset, sheet 12 · Inset, sheet 20 · Inset, sheet 13 · Inset, sheet 21 · Inset, sheet 50 · Inset, sheet 51 · Inset, sheet 61 · Inset, sheet 69 · Inset, sheet 70

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85

ELLIS COUNTY · HENDERSON COUNTY · HILL COUNTY · FREESTONE COUNTY · LIMESTONE COUNTY

Rice · Emhouse · Roane · Powell · Kerens · Barry · Frost · Blooming Grove · CORSICANA · Retreat · Navarro · Eureka · Purdon · Richland · Streetman · Dawson

Trinity River · Grays Creek · Cummins Cr · Waxahachie Cr · Chambers Cr · Mill Cr · Cryer Creek · Post Oak Cr · Cottonwood Cr · Carroll Br · Briar Cr · Rice Br · Slough · Tupelo Br · Hackberry Cr · Willow Cr · Little Rush Cr · Humphries Cr · Indian Cr · Lake Corsicana · Lake Halbert · Oak Creek · Elm Cr · Cedar Creek · Chambers Creek · Little Cedar Cr · Alligator Cr · Richland Creek · Crab Cr · Grape Creek · Hackberry Cr · Strain Br · Tom Harris Br · Wolf Cr · Hughes Br · Melton Creek · Treadwell Br · Battle Cr · Grimes Creek · Board Cr · Pin Oak Cr · Mesquite Cr · Little Elm Cr

CHICAGO ROCK ISLAND AND PACIFIC · F W & D · S P · SOUTHERN PACIFIC · SOUTHWESTERN · ST LOUIS · FT WORTH AND DENVER C R I & P · S L S W

NAVARRO MILLS RES · Kerens City Lake

45 · 75 · 287 · 31 · 22 · 14 · 309

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Symbols without a slope letter are those of nearly level soils. A final number, 2 or 3, in the symbol indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
AlC	Altoga silty clay, 2 to 5 percent slopes
AxB	Axtell fine sandy loam, 1 to 3 percent slopes
AxC	Axtell fine sandy loam, 3 to 5 percent slopes
AxC2	Axtell fine sandy loam, 2 to 5 percent slopes, eroded
AxE	Axtell fine sandy loam, 5 to 12 percent slopes
BaF	Bazette silty clay loam, 5 to 20 percent slopes
BmB	Bonham loam, 1 to 3 percent slopes
Bn	Bunyan loam, calcareous variant
BuA	Burleson clay, 0 to 1 percent slopes
BuB	Burleson clay, 1 to 3 percent slopes
ChD	Chickasha fine sandy loam, 3 to 8 percent slopes
CkD2	Chickasha soils, 5 to 10 percent slopes, eroded
CrA	Crockett fine sandy loam, 0 to 1 percent slopes
CrB	Crockett fine sandy loam, 1 to 3 percent slopes
CrC	Crockett fine sandy loam, 3 to 5 percent slopes
CrD	Crockett fine sandy loam, 5 to 8 percent slopes
CtC2	Crockett soils, 2 to 5 percent slopes, eroded
CtD3	Crockett soils, 2 to 8 percent slopes, severely eroded
DoB	Dougherty loamy fine sand, 0 to 3 percent slopes
EIE	Ellis clay, 3 to 12 percent slopes
EnC	Engle clay loam, 1 to 5 percent slopes
FeD2	Ferris clay, 3 to 8 percent slopes, eroded
FhE2	Ferris and Heiden clays, 5 to 15 percent slopes, eroded
FlE	Ferris and Heiden stony clays, 8 to 15 percent slopes
FrA	Freestone fine sandy loam, 0 to 1 percent slopes
FrB	Freestone fine sandy loam, 1 to 3 percent slopes
Gn	Gowen fine sandy loam
Go	Gowen fine sandy loam, frequently flooded
Gw	Gowen clay loam
Gy	Gowen clay loam, frequently flooded
HaB	Heiden clay, 1 to 3 percent slopes
HaC	Heiden clay, 3 to 5 percent slopes
HaC2	Heiden clay, 3 to 5 percent slopes, eroded
HaD	Heiden clay, 5 to 8 percent slopes
HaD2	Heiden clay, 5 to 8 percent slopes, eroded
HbA	Houston Black clay, 0 to 1 percent slopes
HbB	Houston Black clay, 1 to 3 percent slopes
HbC	Houston Black clay, 3 to 5 percent slopes
HbC2	Houston Black clay, 2 to 5 percent slopes, eroded
HbD	Houston Black clay, 5 to 8 percent slopes
Ka	Kaufman clay
Kc	Kaufman clay, frequently flooded
KoB	Konawa fine sandy loam, 1 to 3 percent slopes
KoD	Konawa fine sandy loam, 3 to 8 percent slopes
KoD2	Konawa fine sandy loam, 5 to 8 percent slopes, eroded
LaD	Lamar clay loam, 3 to 8 percent slopes
LaE2	Lamar clay loam, 5 to 12 percent slopes, eroded
LuA	Lufkin fine sandy loam, 0 to 1 percent slopes
NmA	Nimrod loamy fine sand, 0 to 2 percent slopes
OkA	Okemah loam, 0 to 1 percent slopes
PaD	Patilo loamy fine sand, 1 to 8 percent slopes
Pr	Pursley clay loam
Ps	Pursley clay loam, frequently flooded
PuC	Purves rocky clay, 1 to 5 percent slopes
StC	Stidham loamy fine sand, 1 to 5 percent slopes
TaA	Tabor fine sandy loam, 0 to 1 percent slopes
Tn	Trinity clay
Tr	Trinity clay, frequently flooded
Tu	Tuckerman loam, ponded
VeE	Venus complex, 5 to 15 percent slopes
WlA	Wilson very fine sandy loam, 0 to 1 percent slopes
WlB	Wilson very fine sandy loam, 1 to 3 percent slopes
WnA	Wilson clay loam, 0 to 1 percent slopes
WnB	Wilson clay loam, 1 to 3 percent slopes
WnC	Wilson clay loam, 3 to 5 percent slopes
WnC2	Wilson clay loam, 2 to 5 percent slopes, eroded

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot
- Flood pool line

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, a pasture and hay group, or a range site, read the introduction it is in for general information about its management. For facts about wildlife turn to the section beginning on p. 44. Absence of data in the column on range sites indicates the soil was not placed in a range site because of its small acreage. Other information is given in tables as follows:

Acreage and extent, table 1, p. 6.
Estimated yields, table 2, p. 38.

Engineering uses of the soils, tables 3, 4, and 5, pp. 48 through 61.
Recreational development, table 6, p. 62.

Map symbol	Mapping unit	Described on page	Capability unit		Pasture and hay group		Range site	
			Symbol	Page	Symbol	Page	Name	Page
AlC	Altoga silty clay, 2 to 5 percent slopes	6	IIIe-4	35	7C	39	Rolling Blackland	42
AxB	Axtell fine sandy loam, 1 to 3 percent slopes	7	IIIe-1	35	8A	40	Tight Sandy Loam	43
AxC	Axtell fine sandy loam, 3 to 5 percent slopes	7	IVe-1	36	8A	40	Tight Sandy Loam	43
AxC2	Axtell fine sandy loam, 2 to 5 percent slopes, eroded	7	IVe-1	36	8A	40	Tight Sandy Loam	43
AxE	Axtell fine sandy loam, 5 to 12 percent slopes	8	VIe-1	37	8B	40	Tight Sandy Loam	43
BaF	Bazette silty clay loam, 5 to 20 percent slopes	8	VIe-2	37	7I	40	Grayland	42
BmB	Bonham loam, 1 to 3 percent slopes	9	IIe-5	34	7C	39	Loam	42
Bn	Bunyan loam, calcareous variant	10	I-2	33	2A	39	Bottomland	41
BuA	Burleson clay, 0 to 1 percent slopes	11	IIw-2	35	7A	39	Grayland	42
BuB	Burleson clay, 1 to 3 percent slopes	11	IIIe-2	35	7A	39	Grayland	42
ChD	Chickasha fine sandy loam, 3 to 8 percent slopes	12	IVe-3	36	8C	40	Loam	42
CkD2	Chickasha soils, 5 to 10 percent slopes, eroded	12	VIe-2	37	8C	40	Loam	42
CrA	Crockett fine sandy loam, 0 to 1 percent slopes	13	IIIs-1	36	8A	40	Grayland	42
CrB	Crockett fine sandy loam, 1 to 3 percent slopes	13	IIIe-1	35	8A	40	Grayland	42
CrC	Crockett fine sandy loam, 3 to 5 percent slopes	13	IVe-1	36	8A	40	Grayland	42
CrD	Crockett fine sandy loam, 5 to 8 percent slopes	13	VIe-1	37	8B	40	Grayland	42
CtC2	Crockett soils, 2 to 5 percent slopes, eroded	13	IVe-5	37	8A	40	Grayland	42
CtD3	Crockett soils, 2 to 8 percent slopes, severely eroded	13	VIe-1	37	7I	40	Grayland	42
DoB	Dougherty loamy fine sand, 0 to 3 percent slopes	14	IIs-3	35	9A	40	Sandy	43
ElE	Ellis clay, 3 to 12 percent slopes	14	VIe-1	37	7B	39	Shaly Hardland	43
EnC	Engle clay loam, 1 to 5 percent slopes	15	IIIe-4	35	7C	39	Loam	42
FeD2	Ferris clay, 3 to 8 percent slopes, eroded	16	IVe-2	36	7B	39	Rolling Blackland	42
FhE2	Ferris and Heiden clays, 5 to 15 percent slopes, eroded	16	VIe-2	37	7B	39	Rolling Blackland	42
FlE	Ferris and Heiden stony clays, 8 to 15 percent slopes	17	VIe-2	37	7B	39	Rolling Blackland	42
FrA	Freestone fine sandy loam, 0 to 1 percent slopes	18	I-3	33	8C	40	Sandy Loam	43
FrB	Freestone fine sandy loam, 1 to 3 percent slopes	18	IIe-3	34	8C	40	Sandy Loam	43
Gn	Gowen fine sandy loam	18	I-2	33	1C	39	Bottomland	41
Go	Gowen fine sandy loam, frequently flooded	18	Vw-1	37	1C	39	Bottomland	41
Gw	Gowen clay loam	18	I-1	33	1C	39	Bottomland	41
Gy	Gowen clay loam, frequently flooded	19	Vw-1	37	1C	39	Bottomland	41
HaB	Heiden clay, 1 to 3 percent slopes	19	IIe-1	34	7A	39	Rolling Blackland	42
HaC	Heiden clay, 3 to 5 percent slopes	19	IIIe-2	35	7A	39	Rolling Blackland	42
HaC2	Heiden clay, 3 to 5 percent slopes, eroded	19	IIIe-3	35	7A	39	Rolling Blackland	42
HaD	Heiden clay, 5 to 8 percent slopes	20	IVe-2	36	7B	39	Rolling Blackland	42
HaD2	Heiden clay, 5 to 8 percent slopes, eroded	20	IVe-2	36	7B	39	Rolling Blackland	42
HbA	Houston Black clay, 0 to 1 percent slopes	20	IIw-2	35	7A	39	Rolling Blackland	42
HbB	Houston Black clay, 1 to 3 percent slopes	20	IIe-1	34	7A	39	Rolling Blackland	42
HbC	Houston Black clay, 3 to 5 percent slopes	21	IIIe-2	35	7A	39	Rolling Blackland	42
HbC2	Houston Black clay, 2 to 5 percent slopes, eroded	21	IIIe-3	35	7A	39	Rolling Blackland	42
HbD	Houston Black clay, 5 to 8 percent slopes	21	IVe-2	36	7B	39	Rolling Blackland	42
Ka	Kaufman clay	21	IIw-1	34	1A	39	Bottomland	41
Kc	Kaufman clay, frequently flooded	22	Vw-1	37	1A	39	Bottomland	41
KoB	Konawa fine sandy loam, 1 to 3 percent slopes	22	IIe-3	34	8C	40	Sandy Loam	43
KoD	Konawa fine sandy loam, 3 to 8 percent slopes	22	IIIe-6	35	8C	40	Sandy Loam	43
KoD2	Konawa fine sandy loam, 5 to 8 percent slopes, eroded	22	IIIe-7	35	8C	40	Sandy Loam	43
LaD	Lamar clay loam, 3 to 8 percent slopes	23	IVe-3	36	7C	39	Loam	42
LaE2	Lamar clay loam, 5 to 12 percent slopes, eroded	23	VIe-2	37	7D	40	Loam	42
LuA	Lufkin fine sandy loam, 0 to 1 percent slopes	24	IIIw-1	36	8A	40	Tight Sandy Loam	43
NmA	Nimrod loamy fine sand, 0 to 2 percent slopes	25	IIs-3	35	9A	40	Sandy	43
OkA	Okemah loam, 0 to 1 percent slopes	25	I-4	33	7C	39	Loam	42
PaD	Patilo loamy fine sand, 1 to 8 percent slopes	26	IIIs-2	36	9B	40	Sandy	43
Pr	Pursley clay loam	26	I-1	33	1C	39	Bottomland	41
Ps	Pursley clay loam, frequently flooded	27	Vw-1	37	1C	39	Bottomland	41
PuC	Purves rocky clay, 1 to 5 percent slopes	27	VIs-1	37	13A	40	----------	--
StC	Stidham loamy fine sand, 1 to 5 percent slopes	28	IIIe-8	36	9A	40	Sandy	43
TaA	Tabor fine sandy loam, 0 to 1 percent slopes	29	IIIs-1	36	8A	40	Sandy Loam	43
Tn	Trinity clay	29	IIw-1	34	1A	39	Bottomland	41
Tr	Trinity clay, frequently flooded	29	Vw-1	37	1A	39	Bottomland	41
Tu	Tuckerman loam, ponded	30	VIw-1	37	8E	40	----------	--
VeE	Venus complex, 5 to 15 percent slopes	30	VIe-2	37	7D	40	Loam	42
WlA	Wilson very fine sandy loam, 0 to 1 percent slopes	31	IIIs-3	36	8A	40	Grayland	42
WlB	Wilson very fine sandy loam, 1 to 3 percent slopes	31	IIIe-1	35	8A	40	Grayland	42
WnA	Wilson clay loam, 0 to 1 percent slopes	31	IIIs-3	36	7H	40	Grayland	42
WnB	Wilson clay loam, 1 to 3 percent slopes	32	IIIe-1	35	7H	40	Grayland	42
WnC	Wilson clay loam, 3 to 5 percent slopes	32	IVe-1	36	7H	40	Grayland	42
WnC2	Wilson clay loam, 2 to 5 percent slopes, eroded	32	IVe-5	37	7I	40	Grayland	42

NAVARRO COUNTY, TEXAS — SHEET NUMBER 1

(1)

NAVARRO COUNTY, TEXAS NO. 1

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 10

10

N

Scale 1 : 20 000

1 Mile

5 000 Feet

(Joins sheet 9)

(Joins sheet 5)

(Joins sheet 11)

(Joins sheet 17)

2 360 000 FEET

2 340 000 FEET

210 000 FEET

195 000 FEET

Chatfield

Hackberry

North Branch Middle Creek

Willow Creek

Montfort

SITE 7A

SITE 7B

SITE 7C

SITE 8

SITE 9

SITE 10

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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NAVARRO COUNTY, TEXAS NO. 10

NAVARRO COUNTY, TEXAS — SHEET NUMBER 11

11

N

2 365 000 FEET

210 000 FEET

(Joins sheet 6)

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 18)

2 385 000 FEET

200 000 FEET

Willow Creek

Westbrook Creek

Rush Creek

SITE 104

SITE 105

BAZETTE PRAIRIE POINT CEMETERY

Scale 1 : 20 000

1 Mile

5 000 Feet

NAVARRO COUNTY, TEXAS NO. 11

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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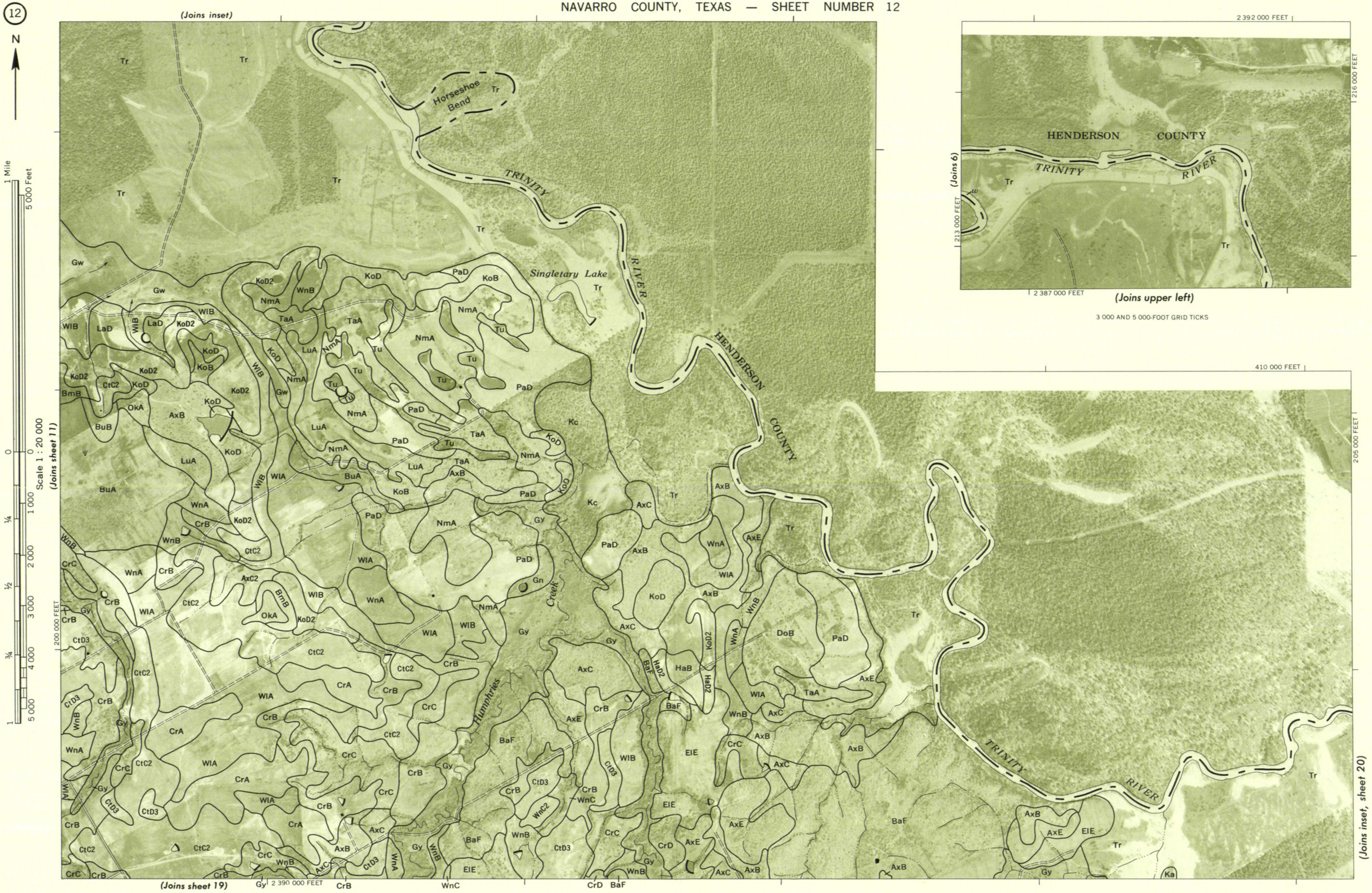
NAVARRO COUNTY, TEXAS — SHEET NUMBER 12



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 13

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2 240 000 FEET

190 000 FEET

179 000 FEET

177 000 FEET

2 232 000 FEET

2 236 000 FEET

(Joins sheet 21)

(Joins lower left)

2 000 AND 4 000-FOOT GRID TICKS

(Joins inset)

(Joins sheet 22)

2 260 000 FEET

(Joins sheet 14)

180 000 FEET

N

1 Mile

5 000 Feet

Scale 1 : 20 000

N

(Joins sheet 7)

2 285 000 FEET

ELLIS CO

Chambers Creek

Brim Creek

SITE 121

SITE 122B

SITE 124

SITE 123A

SITE 123B

Emhouse

CHICAGO, ROCK ISLAND AND PACIFIC

FORT WORTH AND DENVER

PATTERSON CEMETERY

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 23)

180 000 FEET

190 000 FEET

2 265 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

1 000 Meters

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 15

NAVARRO COUNTY, TEXAS NO. 15

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

15

N

2 290 000 FEET

190 000 FEET

180 000 FEET

2 310 000 FEET

(Joins sheet 8)

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 24)

Chambers Creek

Waxahachie Slough

Emhouse

ALLISON RANCH AIRPORT

F W AND P C R I AND P

SITE 1244

1 Mile

5 000 Feet

Scale 1 : 20 000

NAVARRO COUNTY, TEXAS — SHEET NUMBER 16

N

(Joins sheet 9)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 25)

Scale 1 : 20 000

1 Mile — ¾ — ½ — ¼ — 0

5 000 Feet — 4 000 — 3 000 — 2 000 — 1 000 — 0

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 17

NAVARRO COUNTY, TEXAS NO. 17

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 340 000 FEET

190 000 FEET

(Joins sheet 16)

(Joins sheet 10)

(Joins sheet 18)

(Joins sheet 26)

180 000 FEET

2 360 000 FEET

17

N

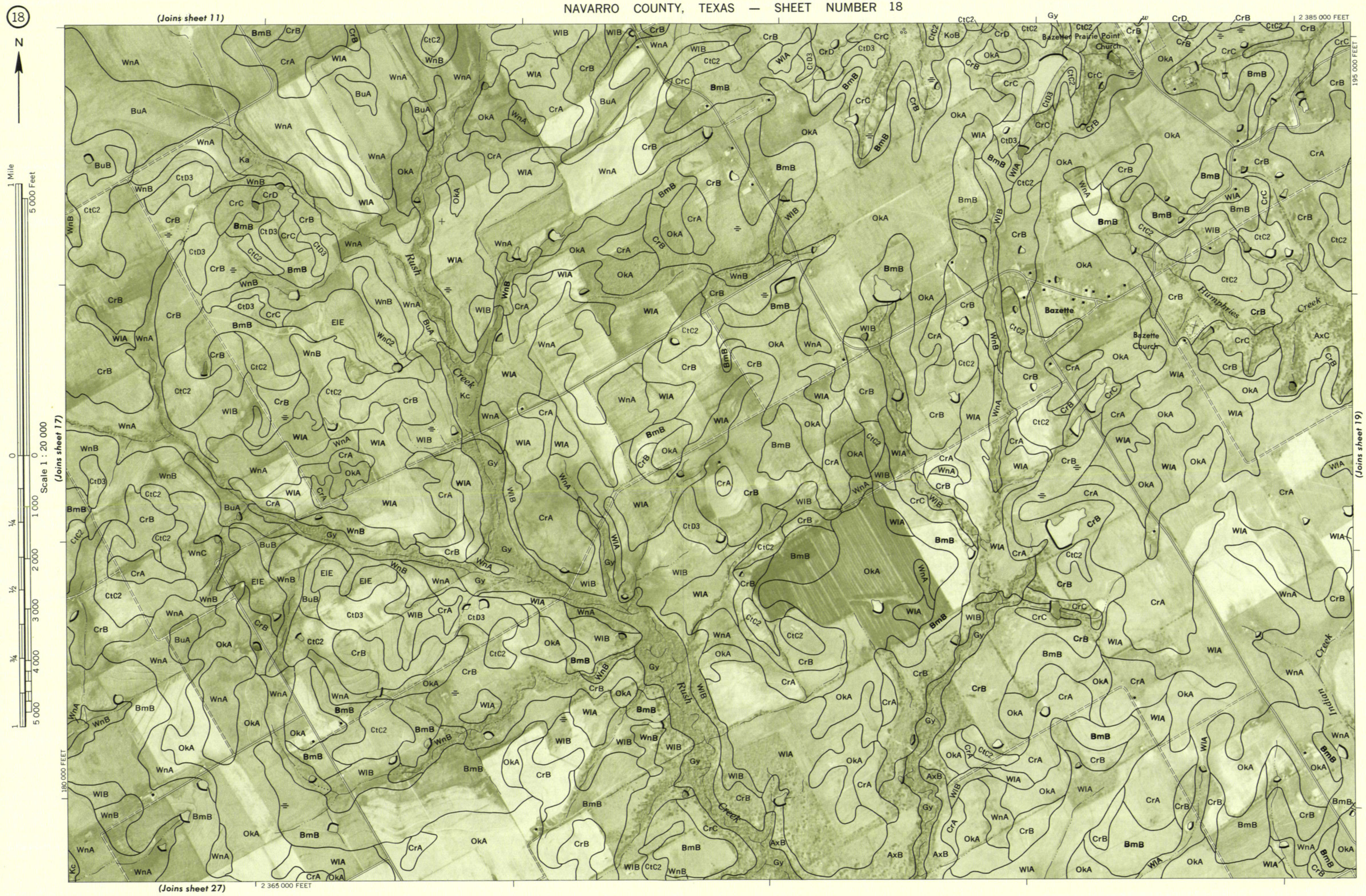
1 Mile

5 000 Feet

Scale 1 : 20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 19

19

N

(Joins sheet 12)

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 28)

2 390 000 FEET

195 000 FEET

180 000 FEET

2 410 000 FEET

Scale 1 : 20 000

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 19

Humphries Creek

Trigg Creek

Indian Creek

Cow Creek

Landing Strip

WEATHERBEE CEMETERY

Oak Grove Church

COUNTY

HENDERSON

TRINITY RIVER

(2)

NAVARRO COUNTY, TEXAS — SHEET NUMBER 2

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

20

N

1 Mile
5 000 Feet
Scale 1 : 20 000
(Joins sheet 19)

(Joins inset)

2 435 000 FEET

195 000 FEET

2 418 000 FEET

203 000 FEET

198 000 FEET

(Joins sheet 12)

2 413 000 FEET (Joins upper left)

180 000 FEET

(Joins sheet 29)

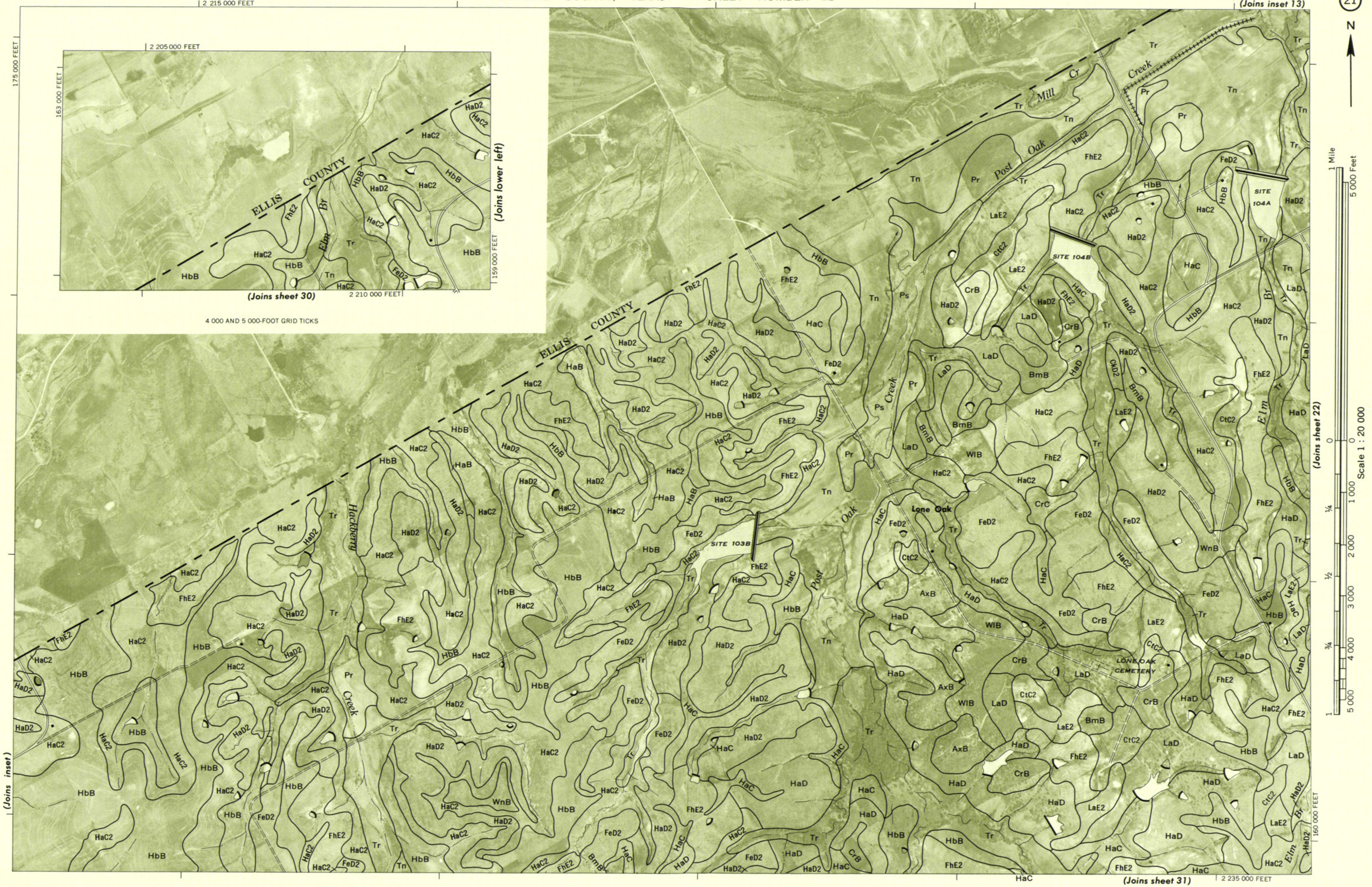
2 415 000 FEET

DoB

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 20



NAVARRO COUNTY, TEXAS NO. 21

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 13)

N

2 260 000 FEET

1 175 000 FEET

1 Mile

5 000 Feet

0

Scale 1 : 20 000

(Joins sheet 21)

(Joins sheet 23)

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000

160 000 FEET

(Joins sheet 32)

2 240 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 23

NAVARRO COUNTY, TEXAS NO. 23

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 265 000 FEET

175 000 FEET

(Joins sheet 14)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 33)

2 285 000 FEET

165 000 FEET

23

N

1 Mile

5 000 Feet

Scale 1 : 20 000

24

N

(Joins sheet 15)

2 310 000 FEET

175 000 FEET

1 Mile

5 000 Feet

0 0

Scale 1 : 20 000

(Joins sheet 23)

165 000 FEET

(Joins sheet 34) 2 290 000 FEET

(Joins sheet 25)

Briar Creek

Black Hills

Black Hills Church

PROVIDENCE CEMETERY

CHICAGO, ROCK ISLAND AND PACIFIC

FORT WORTH AND DENVER

SITE 139

Oak Creek

Past

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 24

NAVARRO COUNTY, TEXAS — SHEET NUMBER 25

25

N

(Joins sheet 16)

(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 35)

2 315 000 FEET

2 335 000 FEET

175 000 FEET

165 000 FEET

CORSICANA
(county seat)

PROVIDENCE CEMETERY

ZION REST CEMETERY

Briar Creek

Chambers Creek

Pettys Chapel

SOUTHERN PACIFIC

UNDERGROUND

GABLE

FORT WORTH AND DENVER CITY

CHICAGO ROCK ISLAND AND PACIFIC

287 75

45

1 Mile

5 000 Feet

Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 25

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 26

26

N

(Joins sheet 17)

2 360 000 FEET

175 000 FEET

(Joins sheet 25)

(Joins sheet 27)

1 Mile

5 000 Feet

Scale 1 : 20 000

165 000 FEET

(Joins sheet 36)

2 340 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 26

Tupelo Branch
Chambers Creek
Bryant Br
Little Rush Creek
Briar Creek
Jamison Creek
Chambers Creek
Four Acres Creek
ST LOUIS SOUTHWESTERN
LAKE CORSICANA

NAVARRO COUNTY, TEXAS NO. 27

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 19)

2 410 000 FEET

BaF

N

1 Mile

5 000 Feet

Scale 1 : 20 000

0 0

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

(Joins sheet 27)

(Joins sheet 29)

175 000 FEET

165 000 FEET

(Joins sheet 38)

2 390 000 FEET

Kerens

Goodlow Park

KERENS CEMETERY

SOUTHWESTERN

ST LOUIS

Indian Creek

Rush Creek

Cow Creek

Gy Creek

Kerens City Lake

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 29

29

N

(Joins sheet 20)

(Joins sheet 28)

(Joins sheet 39)

2 415 000 FEET

2 435 000 FEET

175 000 FEET

165 000 FEET

Daniels Lake

RIVER

NAVARRO COUNTY

HENDERSON COUNTY

TRINITY

SOUTHWESTERN ST LOUIS

GRAVEL PIT

SAMARIA CEMETERY

Goodnight

Creek

Indian Creek

1 Mile

5 000 Feet

Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 29

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 3

NAVARRO COUNTY, TEXAS NO. 3

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 290 000 FEET

225 000 FEET

ELLIS COUNTY

Cummins Creek

Rice

SOUTHERN PACIFIC

UNDERGROUND CABLE

RICE CEM

Br

(Joins sheet 4)

(Joins sheet 8)

215 000 FEET

2 310 000 FEET

WnC

WnC2

3

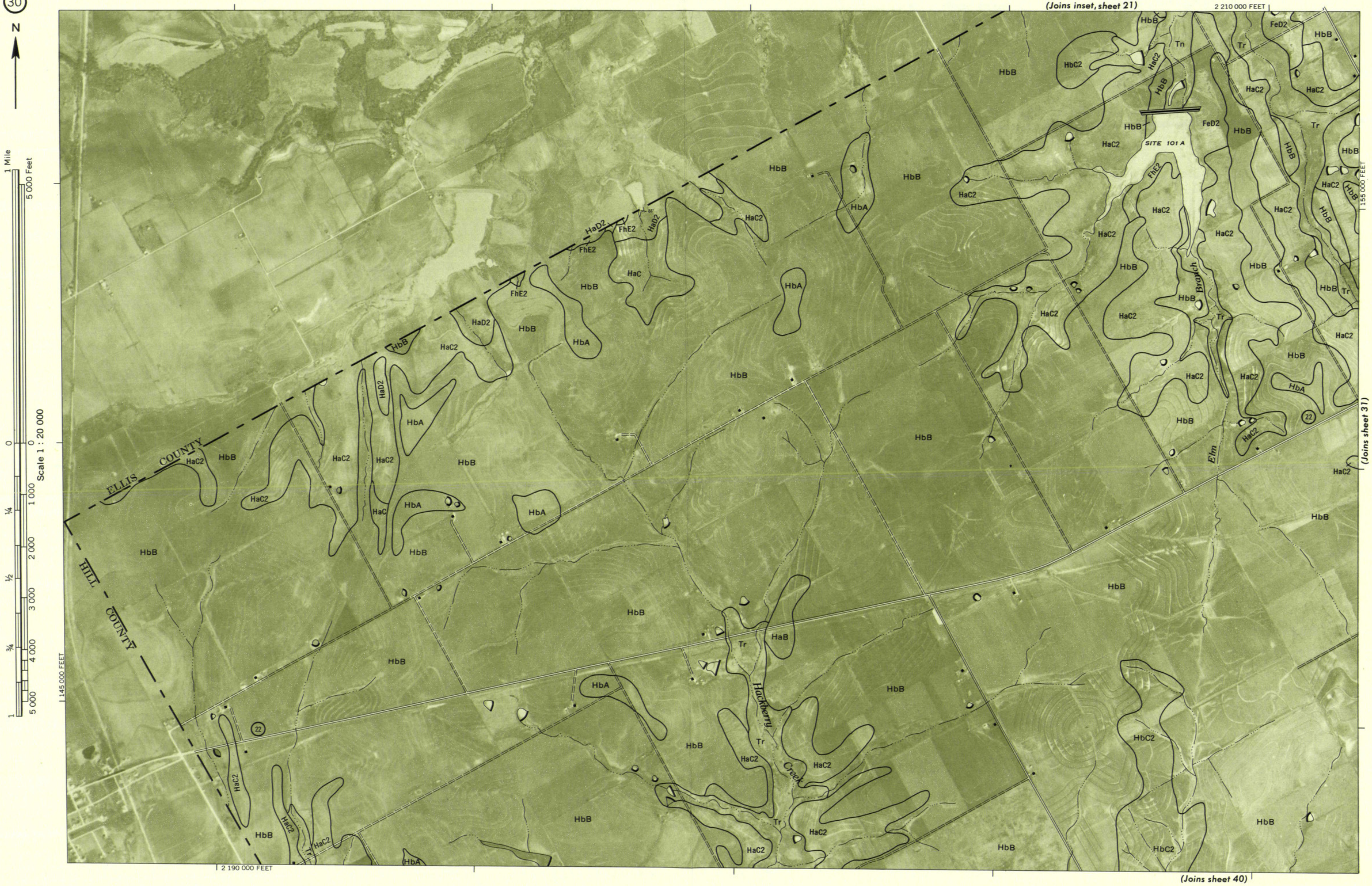
N

1 Mile

5 000 Feet

Scale 1 : 20 000

NAVARRO COUNTY, TEXAS — SHEET NUMBER 30



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 31

NAVARRO COUNTY, TEXAS NO. 31

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 215 000 FEET

155 000 FEET

(Joins sheet 30)

(Joins sheet 21)

(Joins sheet 32)

(Joins sheet 41)

2 235 000 FEET

145 000 FEET

Frost

Hackberry Creek

Post Oak Creek

Elm Br

SITE 120

N

Scale 1 : 20 000

1 Mile

5 000 Feet

NAVARRO COUNTY, TEXAS — SHEET NUMBER 32

(32)

N

(Joins sheet 22)

2 260 000 FEET

155 000 FEET

(Joins sheet 33)

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins sheet 31)

145 000 FEET

2 240 000 FEET

(Joins sheet 42)

Blooming Grove

Carroll Branch

Rush Creek

East Fork

Cattonwood Creek

SITE 121

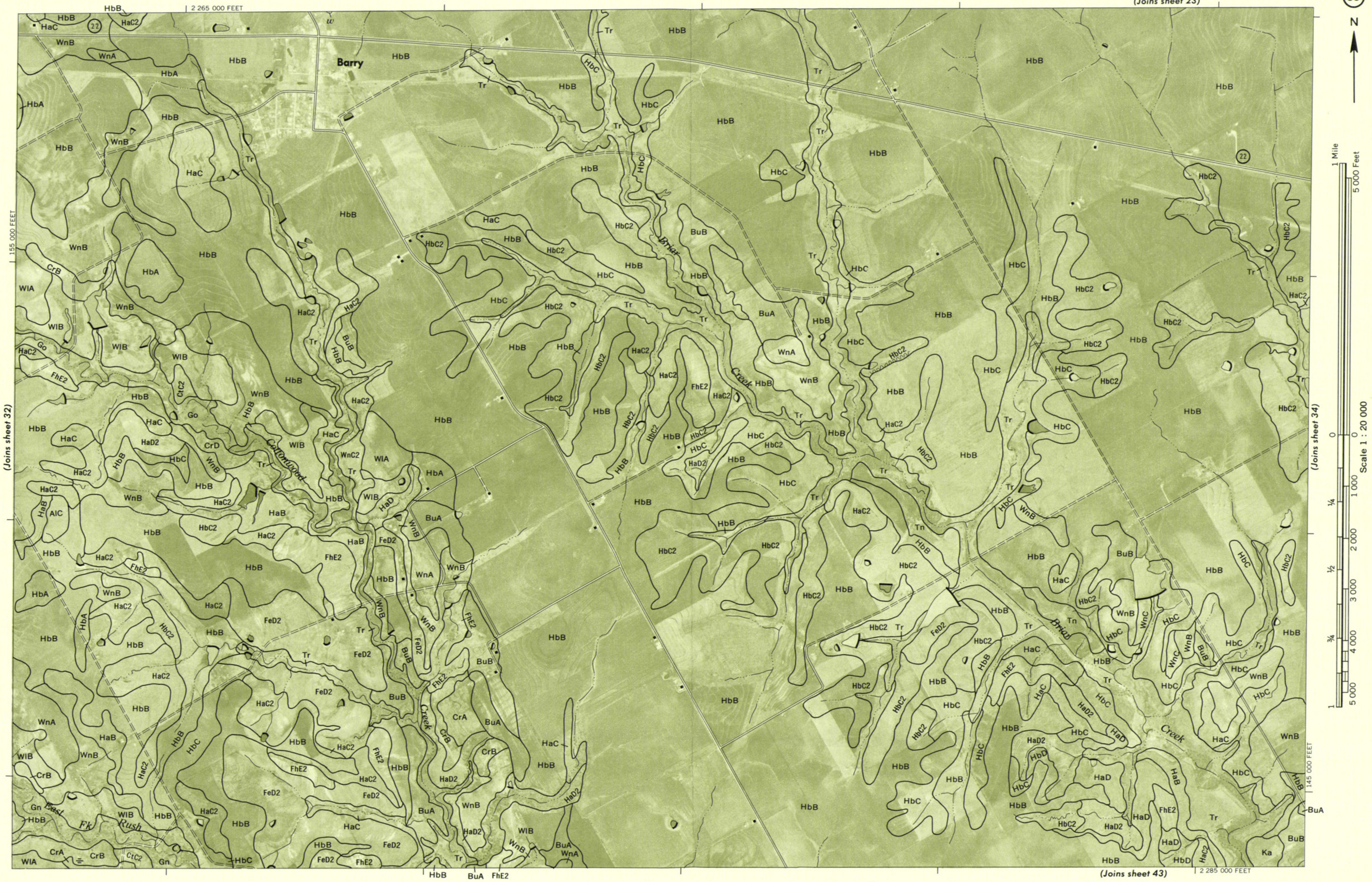
SITE 123

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 32

Gn — CrB — WIA



NAVARRO COUNTY, TEXAS NO. 33

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 34

(34)

N

(Joins sheet 24)

(Joins sheet 33)

(Joins sheet 35)

(Joins sheet 44)

2 310 000 FEET

160 000 FEET

145 000 FEET

2 290 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

SITE 139

CORSICANA
(county seat)

Post Oak

Whites Chapel

CUNNINGHAM CEMETERY

BORROW PIT

Pleasant Grove Church

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 34

NAVARRO COUNTY, TEXAS NO. 35

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 315 000 FEET

160 000 FEET

(Joins sheet 25)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 45)

2 335 000 FEET

145 000 FEET

N

Scale 1 : 20 000

1 Mile

5 000 Feet

CORSICANA
(county seat)

Post Oak Creek

Town Branch

Mesquite Branch

Magnolia Lake

Beaton Lake

HALBERT LAKE

OAKWOOD CEMETERY

CLAY PIT

BORROW PIT

FORT WORTH AND DENVER SOUTHERN PACIFIC

ST LOUIS SOUTHWESTERN

CHICAGO ROCK ISLAND AND PACIFIC

UNDERGROUND CABLE

B.P.

WIA WIB WnA WnB WnC CrA CrB CrC CtC2 CtD3 AxB BuA BuB EIE FeD2 FhE2 Gn Gw Gy HaB HaC HaD HaC2 HaD2 HbA HbB HbC Ka Kc LaD Tr w

36

N

(Joins sheet 26)

2 360 000 FEET

160 000 FEET

LAKE CORSICANA

LAKE HALBERT

SOUTHWESTERN ST LOUIS

Post Oak Creek

Chambers Creek

SITE 140

SITE 141

1 Mile 5 000 Feet

Scale 1 : 20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 35)

(Joins sheet 37)

145 000 FEET

(Joins sheet 46)

2 340 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 36

NAVARRO COUNTY, TEXAS — SHEET NUMBER 37

37

N

2 365 000 FEET

160 000 FEET

(Joins sheet 27)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 47)

150 000 FEET

2 385 000 FEET

Ebenezer Church

Elm Flat

ELM FLAT CEMETERY

Woods Chapel

WOODS CEMETERY

Chambers Creek

Chambers Creek

1 Mile

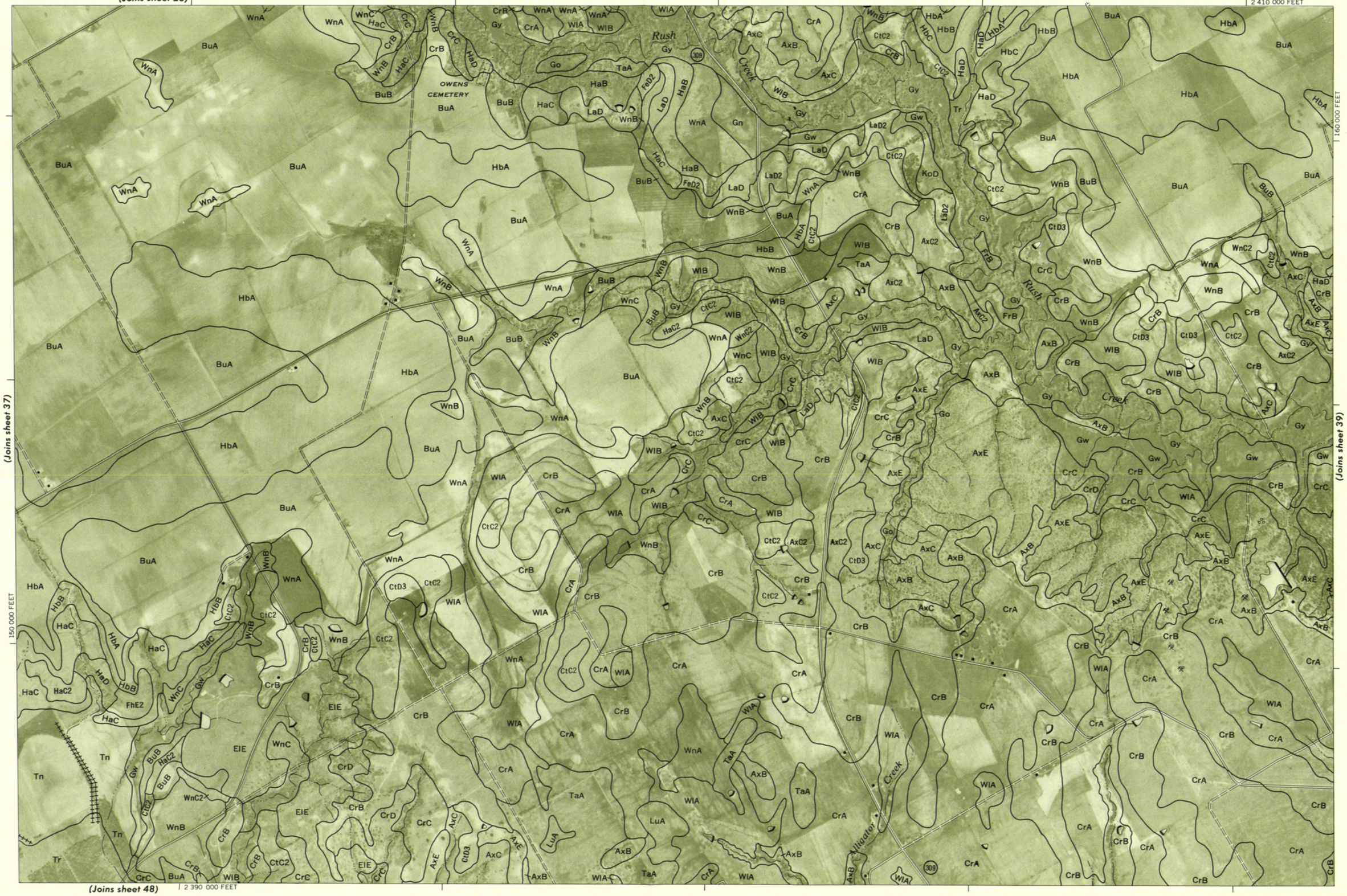
5 000 Feet

Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 37

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station



N

Scale 1 : 20 000

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 38

N

(Joins sheet 29)

2 415 000 FEET

1 160 000 FEET

(Joins sheet 38)

(Joins sheet 49)

2 435 000 FEET

(Joins inset, sheet 50)

1 150 000 FEET

HENDERSON COUNTY

TRINITY RIVER

Indian Creek

Rush Creek

Rush Creek Ranch

water

1 Mile

5 000 Feet

Scale 1 : 20 000

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

NAVARRO COUNTY, TEXAS NO. 39

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins inset, sheet 2)

2 335 000 FEET

225 000 FEET

N

1 Mile 5 000 Feet

Scale 1 : 20 000

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 3)

215 000 FEET

2 315 000 FEET

(Joins sheet 5)

(Joins sheet 9)

ELLIS COUNTY

SITE 1

SITE 2

SITE 3

SITE 4

Grays Creek

RICE CEMETERY

UNDERGROUND CABLE

Rice Res

OLD CHATFIELD CEMETERY

45

75
287

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 4

NAVARRO COUNTY, TEXAS — SHEET NUMBER 40

(40)

N

(Joins sheet 30)

2 210 000 FEET

140 000 FEET

130 000 FEET

2 190 000 FEET

(Joins sheet 41)

(Joins sheet 51)

1 Mile

5 000 Feet

Scale 1 : 20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

SITE 47

HILL COUNTY

Hackberry Creek

Hackberry Creek

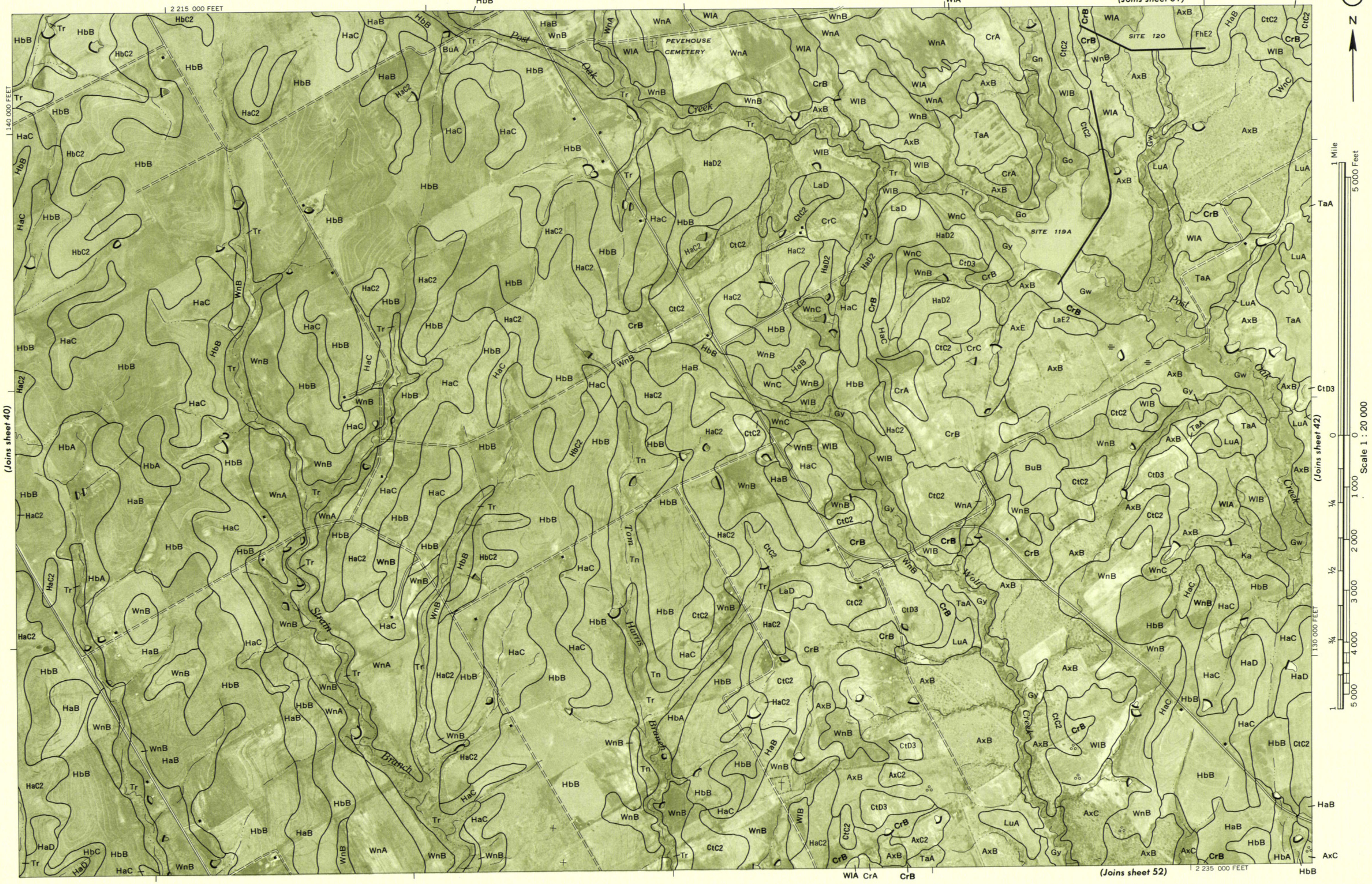
Creek

HbB HaC2 Tr HbA HaC HbC2 HaB FeD2 CtD3 FhE2 HaD2

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 40



NAVARRO COUNTY, TEXAS NO. 41

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

Scale 1 : 20 000

1 Mile 0 5 000 Feet

¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

(Joins sheet 32) (Joins sheet 41) (Joins sheet 43) AxB (Joins sheet 53)

2 260 000 FEET 2 240 000 FEET 1 140 000 FEET 1 130 000 FEET

SITE 121 SITE 124

Pleasant Grove Church

Rush Creek

Brim Br.

Carroll Branch

Post Oak Creek

Melton Branch

Dresden

DRESDEN CEMETERY

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 43

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 33)
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 54)

2 265 000 FEET
2 285 000 FEET
140 000 FEET
130 000 FEET

Rush Creek
East Fork Rush Creek
Cottonwood Creek
Briar Ck
Drane
CAMPBELL CEMETERY
Melton Br

N

1 Mile
5 000 Feet
Scale 1 : 20 000

N

(Joins sheet 34)

(Joins sheet 43)

(Joins sheet 55)

(Joins sheet 44)

2 310 000 FEET

2 290 000 FEET

140 000 FEET

130 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

Briar Creek

Cedar Creek

RESTHAVEN CEMETERY

MARSHALL CEMETERY

COSGROVE CEMETERY

Community Church

ST. LOUIS SOUTHWESTERN

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 45

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 44)

(Joins sheet 35)

(Joins sheet 46)

(Joins sheet 56)

2 315 000 FEET

2 335 000 FEET

140 000 FEET

130 000 FEET

45

N

1 Mile

5 000 Feet

Scale 1 : 20 000

0 0 ¼ ½ ¾ 1

5 000 1 000 2 000 3 000 4 000 5 000

Beaton Lake

LAKE HALBERT

Retreat

Pickett

Cedar Creek Church

HAMILTON BREMEN CEMETERY

Elm Creek

Grape Creek

Cable Creek

SOUTHERN PACIFIC UNDERGROUND

FWD AND D

(Joins sheet 36)

(Joins sheet 47)

(Joins sheet 57)

(Joins sheet 45)

2 360 000 FEET

145 000 FEET

130 000 FEET

Scale 1 : 20 000

1 Mile

5 000 Feet

CAMP WANICA

CORSICANA MUNICIPAL AIRPORT

Cedar Creek

Cedar Creek

Crab Creek

Mildred

Providence Church

PROVIDENCE CEMETERY

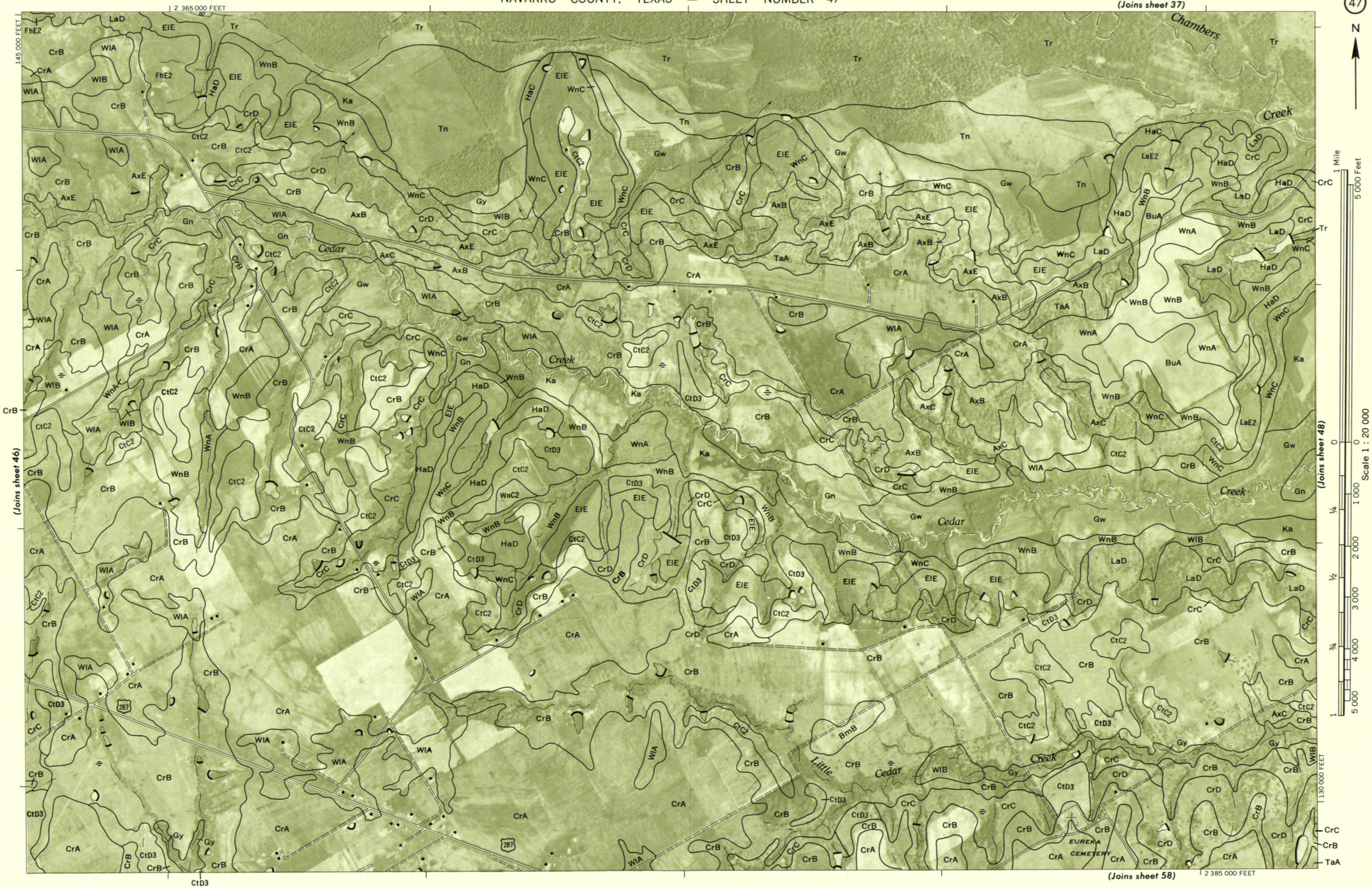
CHICAGO ROCK ISLAND AND FORT WORTH DENVER PACIFIC

287

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 46



NAVARRO COUNTY, TEXAS NO. 47

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 38)

N

2 410 000 FEET

145 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 47)

(Joins sheet 49)

1 130 000 FEET

2 390 000 FEET

(Joins sheet 59)

Chambers Creek

Cedar Creek

Little Cedar Creek

Alligator Creek

Round Prairie

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

2 415 000 FEET

145 000 FEET

(Joins sheet 39)

(Joins sheet 48)

(Joins sheet 50)

(Joins sheet 60)

2 435 000 FEET

130 000 FEET

Rural Shade

Alligator Creek

INGRAM CEMETERY

PRINCETON CEMETERY

Scale 1 : 20 000

1 Mile

5 000 Feet

0 0

1 000 2 000 3 000 4 000 5 000

1/4 1/2 3/4 1

NAVARRO COUNTY, TEXAS NO. 49

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 5

NAVARRO COUNTY, TEXAS NO. 5

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 340 000 FEET

1 225 000 FEET

(Joins sheet 1)

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 10)

2 360 000 FEET

215 000 FEET

5

N

1 Mile

5 000 Feet

Scale 1 : 20 000

TIMOTHY CEMETERY

Finch School

Timothy

GRAVEL PIT

SITE 5

SITE 6

NEW CHATFIELD CEM

Grays Creek

Hackberry Creek

Willow Cr

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 51

NAVARRO COUNTY, TEXAS NO. 51

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 190 000 FEET

125 000 FEET

(Joins sheet 40)

51

N

Richland Creek

Hackberry Creek

UNION HILL CEMETERY

HILL COUNTY

MAXIMUM FLOOD POOL

2 207 000 FEET

108 000 FEET

(Joins sheet 62)

103 000 FEET

2 212 000 FEET

2 210 000 FEET

(Joins inset)

(Joins sheet 52)

1 Mile

5 000 Feet

Scale 1 : 20 000

N

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins sheet 51)

(Joins sheet 41)

(Joins sheet 53)

(Joins sheet 62)

2 235 000 FEET

2 215 000 FEET

1 125 000 FEET

1 110 000 FEET

Brushy Prairie

Emmett

EMMETT CEMETERY

Brushie Prairie Church

Wolf Creek Park

Strain Branch

Tom Harris Branch

Hackberry Creek

Richland Creek

Wolf Creek

MAXIMUM FLOOD POOL

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 53

53

N

2 240 000 FEET

2 260 000 FEET

110 000 FEET

125 000 FEET

(Joins sheet 42)

(Joins sheet 52)

(Joins sheet 54)

(Joins sheet 63)

Raleigh

OLD RALEIGH CEMETERY

Hughes Cr.

Post Oak Creek

NAVARRO MILLS RESERVOIR

WOLF CREEK PARK

OAK PARK

SITE 126

SITE 127

Scale 1 : 20 000

1 Mile

5 000 Feet

NAVARRO COUNTY, TEXAS NO. 53

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

54

N

(Joins sheet 43)

2 285 000 FEET

125 000 FEET

(Joins sheet 53)

(Joins sheet 55)

Scale 1 : 20 000

1 Mile 5 000 Feet

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

Melton Branch

Hughes Branch

Rush Creek

Silver City

SITE 129

S L S W

110 000 FEET

2 265 000 FEET

(Joins sheet 64)

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 54

NAVARRO COUNTY, TEXAS — SHEET NUMBER 55

55

N

2 290 000 FEET

125 000 FEET

(Joins sheet 44)

(Joins sheet 54)

(Joins sheet 56)

(Joins sheet 65)

2 310 000 FEET

115 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 55

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

56

NAVARRO COUNTY, TEXAS — SHEET NUMBER 56

N

(Joins sheet 45)

2 335 000 FEET

125 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins sheet 55)

115 000 FEET

(Joins sheet 57)

(Joins sheet 66)

2 315 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 56

NAVARRO COUNTY, TEXAS NO. 57

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 340 000 FEET

125 000 FEET

(Joins sheet 46)

(Joins sheet 56)

(Joins sheet 58)

(Joins sheet 67)

115 000 FEET

2 360 000 FEET

N

1 Mile

5 000 Feet

Scale 1 : 20 000

Navarro

CHICAGO ROCK ISLAND AND FORT WORTH PACIFIC DENVER

Grape Creek

Creek

GRAPE CREEK CEMETERY

HOPEWELL CEMETERY

N

(Joins sheet 47)

2 385 000 FEET

(Joins sheet 57)

(Joins sheet 59)

125 000 FEET

115 000 FEET

(Joins sheet 68)

2 365 000 FEET

Scale 1 : 20 000

1 Mile

5 000 Feet

0 1 000 2 000 3 000 4 000 5 000

0 ¼ ½ ¾ 1

Eureka

GUNN CEMETERY

JOHNSON CEMETERY

Friendship Church

Crab Creek

Jones Branch

Richland Creek

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 59

59

NAVARRO COUNTY, TEXAS NO. 59

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 390 000 FEET

125 000 FEET

(Joins sheet 48)

(Joins sheet 58)

(Joins sheet 60)

(Joins sheet 69)

2 410 000 FEET

115 000 FEET

N

Scale 1 : 20 000

1 Mile

5 000 Feet

NAVARRO COUNTY, TEXAS — SHEET NUMBER 6

6

N

(Joins sheet 2)

2 385 000 FEET

2 225 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins sheet 5)

215 000 FEET

(Joins sheet 11)

2 365 000 FEET

(Joins inset, sheet 12)

Tn

Tr

Ka

BuA

TRINITY RIVER

HENDERSON COUNTY

Grays Creek

Hackberry Creek

Willow Creek

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 6

NAVARRO COUNTY, TEXAS — SHEET NUMBER 60

(Joins sheet 49)

2 435 000 FEET

(Joins sheet 61)

125 000 FEET

N

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins sheet 59)

115 000 FEET

(Joins inset, sheet 61)

2 415 000 FEET

Alligator Creek

PETERSBURG CEMETERY

Petersburg Church

LAKE CARROLL

INDEFINITE BOUNDARY

FREESTONE COUNTY

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 60

N

(Joins sheet 50) | 2 440 000 FEET

KoD
Gn
StC
Gw
PaD
Kc
PaD
StC
Tr
Tr
Ps
Ps
Tr
TRINITY RIVER
HENDERSON CO
FREESTONE COUNTY
BOUNDARY
CARROLL LAKE
INDEFINITE
Tr
(Joins sheet 60)

| 125 000 FEET

(Joins sheet 60) | 2 415 000 FEET

Tn
Tr
Richland Creek
Tr
BOUNDARY
AxB
Tr
Tr
Gn
AxE
COUNTY
Gn
AxB
FREESTONE
AxC
AxE
Gn
GtC2
INDEFINITE
(Joins sheet 69)

| 112 000 FEET

| 107 000 FEET

| 2 420 000 FEET

| 115 000 FEET

| 2 460 000 FEET

1 Mile
5 000 Feet
0
¼
½
¾
1
5 000
4 000
3 000
2 000
1 000
0
Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 61

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins inset, sheet 51)

(Joins sheet 52)

2 235 000 FEET

105 000 FEET

95 000 FEET

2 215 000 FEET

(Joins sheet 63)

(Joins sheet 70)

Richland Creek

Pelham

PELHAM CEMETERY

Strain Branch

Tom Harris Br

WOLF CREEK PARK

Treadwell Branch

NAVARRO MILLS RESERVOIR

NAVARRO COUNTY

HILL COUNTY

MAXIMUM FLOOD POOL

MAX FLOOD POOL

FLOOD POOL

POOL

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 62

NAVARRO COUNTY, TEXAS — SHEET NUMBER 63

NAVARRO COUNTY, TEXAS NO. 63

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

63

N

1 Mile
5 000 Feet

Scale 1 : 20 000

0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

2 240 000 FEET

105 000 FEET

95 000 FEET

2 260 000 FEET

(Joins sheet 53)

(Joins sheet 62)

(Joins sheet 64)

(Joins sheet 71)

NAVARRO MILLS RESERVOIR

Navarro Mills

Spring Hill

Richland Creek

Post Oak Creek

Treadwell Branch

Battle Creek

SOUTHWESTERN ST LOUIS

BORROW PIT

MAXIMUM POOL

FLOOD POOL

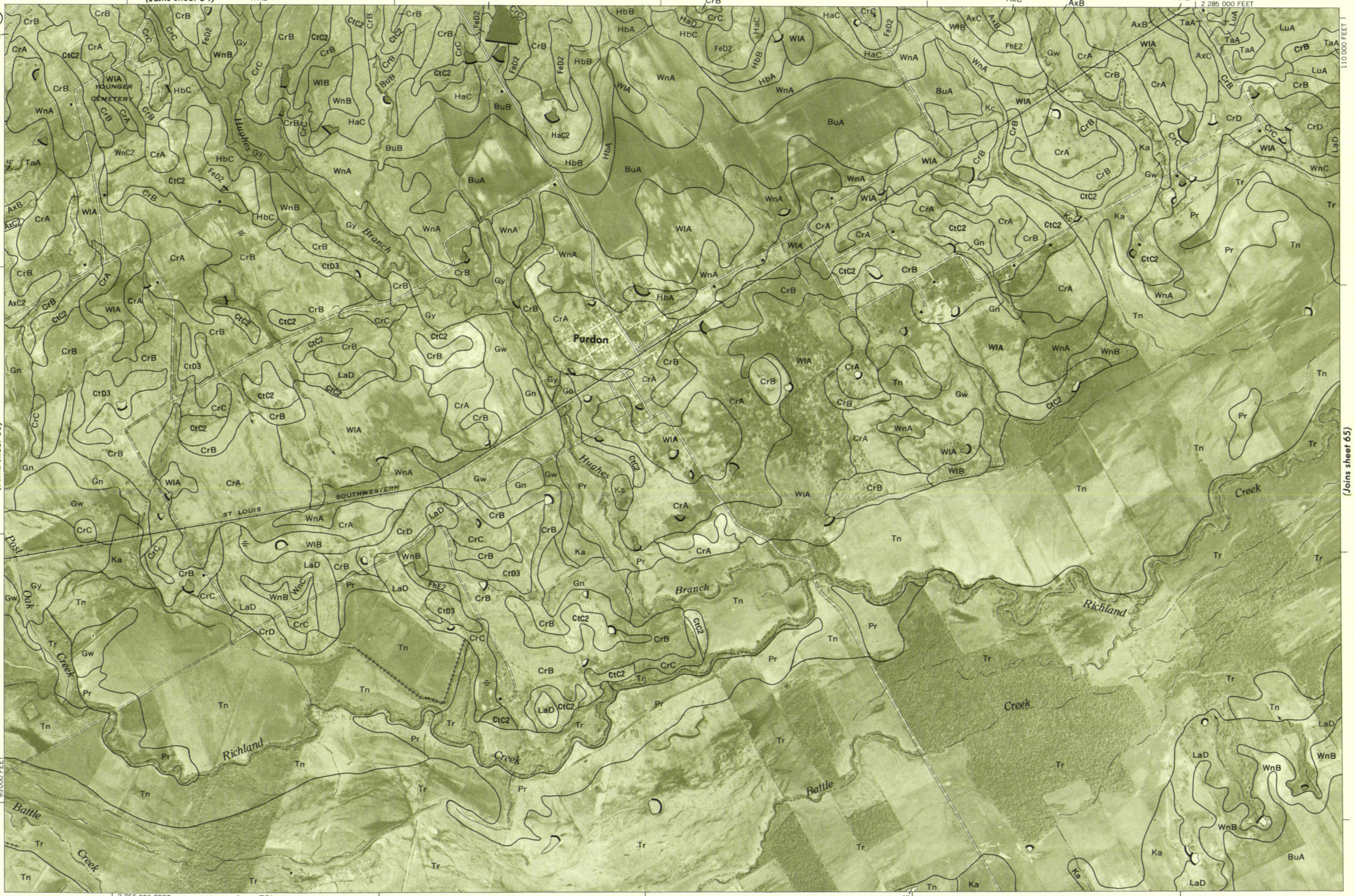
LIBERTY HILL PARK

OAK PARK

NAVARRO COUNTY, TEXAS — SHEET NUMBER 64

N

1 Mile
5 000 Feet
Scale 1 : 20 000
0 1/4 1/2 3/4 1
0 1 000 2 000 3 000 4 000 5 000



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 290 000 FEET

110 000 FEET

(Joins sheet 55)

(Joins sheet 64)

(Joins sheet 66)

(Joins sheet 73)

2 310 000 FEET

95 000 FEET

N

Scale 1 : 20 000

1 Mile

5 000 Feet

Creek

Gimlet Creek

Richland Creek

Battle Creek

Pin Oak Creek

Pursley Church

SITE 35

NAVARRO COUNTY, TEXAS NO. 65

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

Scale 1 : 20 000

1 Mile 5 000 Feet

0 0

¼ 1 000 2 000

½ 3 000

¾ 4 000

1 5 000

(Joins sheet 56)

(Joins sheet 65)

(Joins sheet 74)

(Joins sheet 67)

2 335 000 FEET

1 110 000 FEET

95 000 FEET

2 315 000 FEET

Richland

Richland Creek

Oak Creek

Pin Oak Creek

Love Lake

Richland Cr

PACIFIC

SOUTHERN

UNDERGROUND CABLE

ROCK PIT

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

NAVARRO COUNTY, TEXAS NO. 67

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 340 000 FEET

10 000 FEET

(Joins sheet 57)

(Joins sheet 66)

(Joins sheet 68)

(Joins sheet 75)

2 360 000 FEET

95 000 FEET

1 Mile

5 000 Feet

Scale 1 : 20 000

0 1 000 2 000 3 000 4 000 5 000

0 ¼ ½ ¾ 1

Cheneyboro

CHENEYBORO CEMETERY

Grape Creek

Richland Creek

Patterson Lake

Little Pin Oak Cr

Mesquite Creek

Oak Creek

Elm Creek

CHICAGO, ROCK ISLAND AND PACIFIC

FORT WORTH AND DENVER

N

1 Mile
5 000 Feet
0
Scale 1 : 20 000
1 000 Meters

(Joins sheet 58)

(Joins sheet 67)

(Joins sheet 69)

(Joins sheet 76)

2 385 000 FEET

110 000 FEET

95 000 FEET

2 365 000 FEET

Richland Creek

Crab Creek

Grape Creek

Midway Church

Sprint Branch

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 69

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 390 000 FEET

110 000 FEET

(Joins sheet 68)

(Joins sheet 59)

(Joins inset, sheet 61)

(Joins inset)

2 410 000 FEET

100 000 FEET

69

N

Richland Creek

Pleasant Hill Church

Winkler

Greenbriar

Thomas Chapel

FREESTONE COUNTY

BOUNDARY

INDEFINITE

Tr Tn Kc Gn WlB WnB CrA CrB CrC CrD LaD AxB AxC AxE AxC2 CtC2 CtD3 StC KoB KoD KoD2 PaD NmA LuA TaA Gw

(Joins lower left)

(Joins sheet 76)

2 388 000 FEET

95 000 FEET

2 392 000 FEET

92 000 FEET

3 000 AND 4 000-FOOT GRID TICKS

1 Mile

5 000 Feet

Scale 1 : 20 000

7

(Joins sheet 8)

(Joins sheet 14)

NAVARRO COUNTY, TEXAS NO. 7

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

Scale 1 : 20 000

1 Mile 5 000 Feet

0 ¼ ½ ¾ 1

0 5 000 1 000 2 000 3 000 4 000 5 000

2 237 000 FEET

75 000 FEET

65 000 FEET

2 232 000 FEET

(Joins lower right)

(Joins sheet 77)

2 235 000 FEET

90 000 FEET

80 000 FEET

2 225 000 FEET

(Joins sheet 62)

(Joins sheet 71)

(Joins inset)

HILL COUNTY

MAXIMUM FLOOD POOL

Treadwell Branch

Battle Creek

LIBERTY HILL CEMETERY

Battle Creek Burial Ground

SOUTHWESTERN ST. LOUIS

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 70

N

2 240 000 FEET

90 000 FEET

(Joins sheet 63)

(Joins sheet 70)

(Joins sheet 72)

(Joins sheet 77)

2 260 000 FEET

80 000 FEET

Dawson

Lake Dawson

Battle Creek

Board Creek

SOUTHWESTERN ST. LOUIS

1 Mile 5 000 Feet

Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 71

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 64)

N

Battle Creek

Board Creek

Shiloh Church

2 285 000 FEET

90 000 FEET

80 000 FEET

2 265 000 FEET

(Joins sheet 73)

(Joins sheet 71)

(Joins sheet 78)

1 Mile

5 000 Feet

Scale 1 : 20 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

NAVARRO COUNTY, TEXAS NO. 73

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 290 000 FEET

90 000 FEET

80 000 FEET

2 310 000 FEET

(Joins sheet 65)

(Joins sheet 72)

(Joins sheet 74)

(Joins sheet 79)

Pursley

Pursley Church

Pin Oak Creek

Board Creek

Pin Oak Creek

Board Creek

Pin Oak Creek

Alsah Ridge

SITE 32

SITE 33

SITE 34

SITE 35

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins sheet 66)

(Joins sheet 73)

(Joins sheet 75)

(Joins sheet 80)

2 335 000 FEET

90 000 FEET

80 000 FEET

2 315 000 FEET

N

Scale 1 : 20 000

1 Mile

5 000 Feet

0

1 000

2 000

3 000

4 000

5 000

1/4

1/2

3/4

1

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 74

NAVARRO COUNTY, TEXAS NO. 75

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 74)

(Joins sheet 67)

(Joins sheet 76)

(Joins sheet 81)

2 340 000 FEET

90 000 FEET

80 000 FEET

2 360 000 FEET

Little Pin Oak Creek

Mesquite Creek

Elm Creek

FORT WORTH AND DENVER CITY RAILROAD

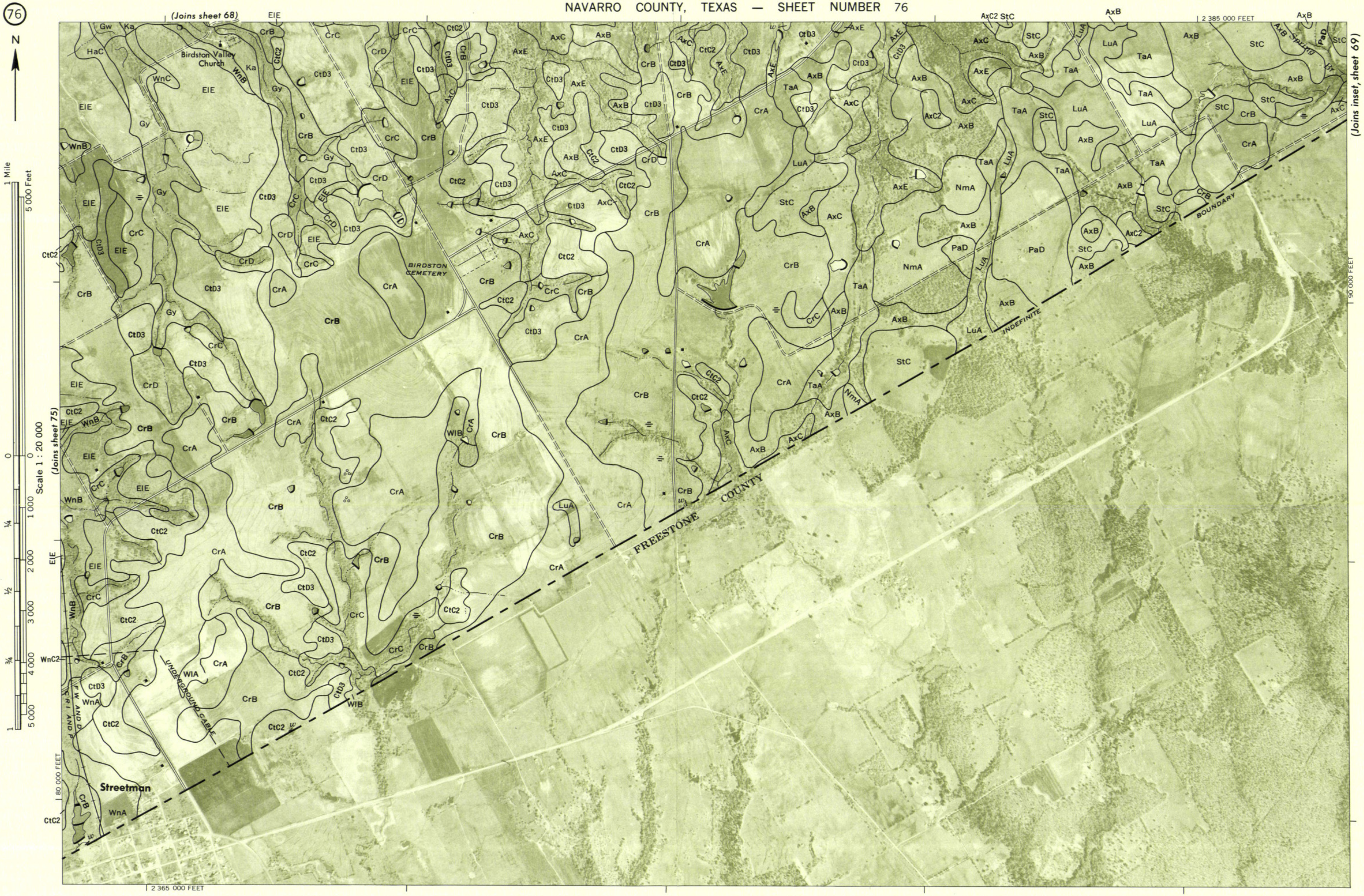
CHICAGO ROCK ISLAND AND PACIFIC

UNDERGROUND CABLE

Scale 1 : 20 000

1 Mile

5 000 Feet



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 77

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 240 000 FEET

75 000 FEET

(Joins inset, sheet 70)

(Joins sheet 71)

77

N

Lake Dawson

SITE 107

North Fork

Pin Oak Creek

Alligator Creek

HILL CO

(Joins sheet 78)

1 Mile

5 000 Feet

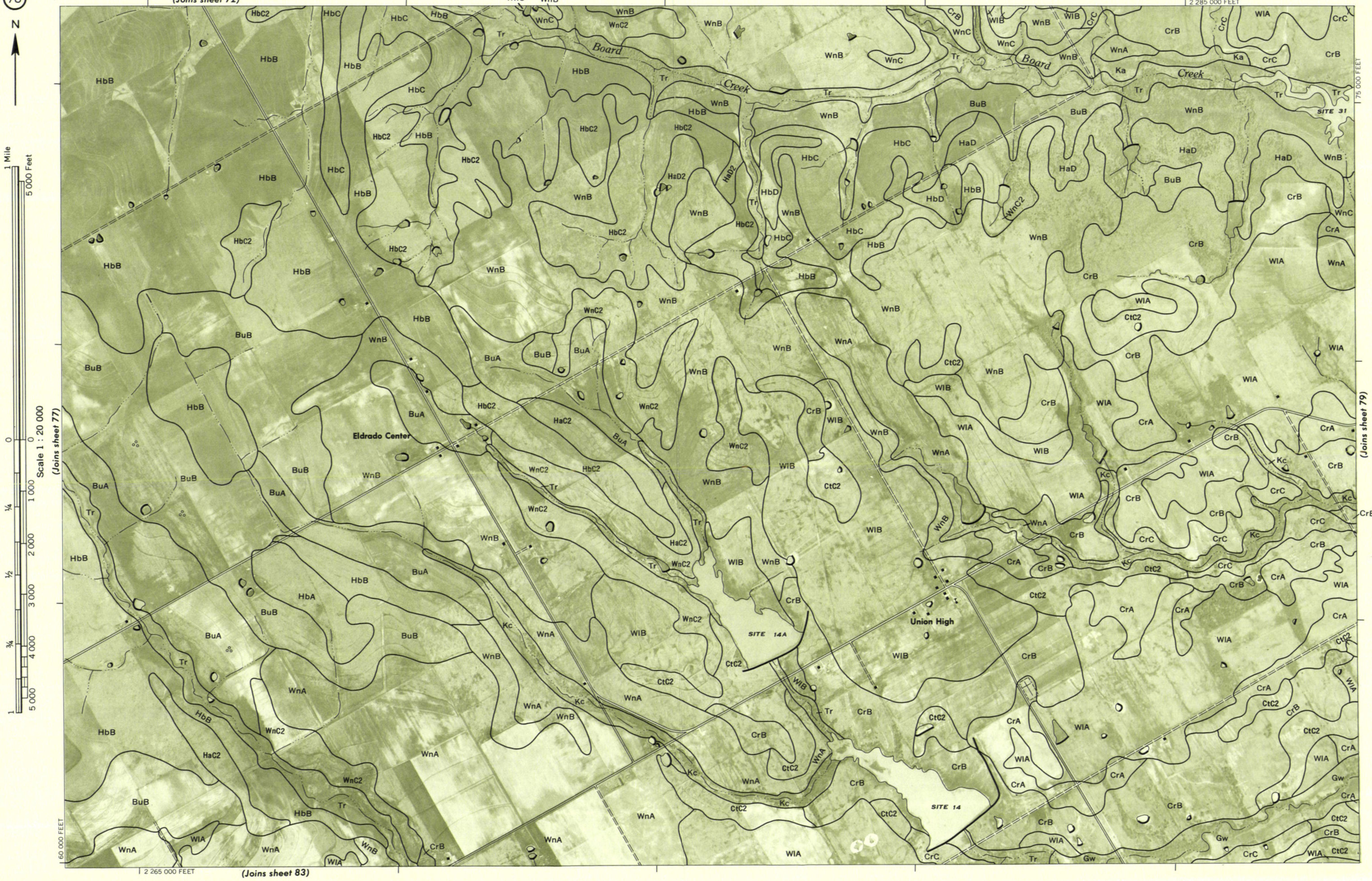
Scale 1 : 20 000

(Joins sheet 82)

2 260 000 FEET

60 000 FEET

NAVARRO COUNTY, TEXAS — SHEET NUMBER 78



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS, NO. 78

NAVARRO COUNTY, TEXAS — SHEET NUMBER 79

NAVARRO COUNTY, TEXAS NO. 79

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

2 290 000 FEET

75 000 FEET

(Joins sheet 73)

(Joins sheet 78)

(Joins sheet 80)

(Joins sheet 84)

2 310 000 FEET

65 000 FEET

N

Scale 1 : 20 000

1 Mile

5 000 Feet

Board Creek

Shady Grove Church

MT NEPO CEMETERY

Oak Pin Creek

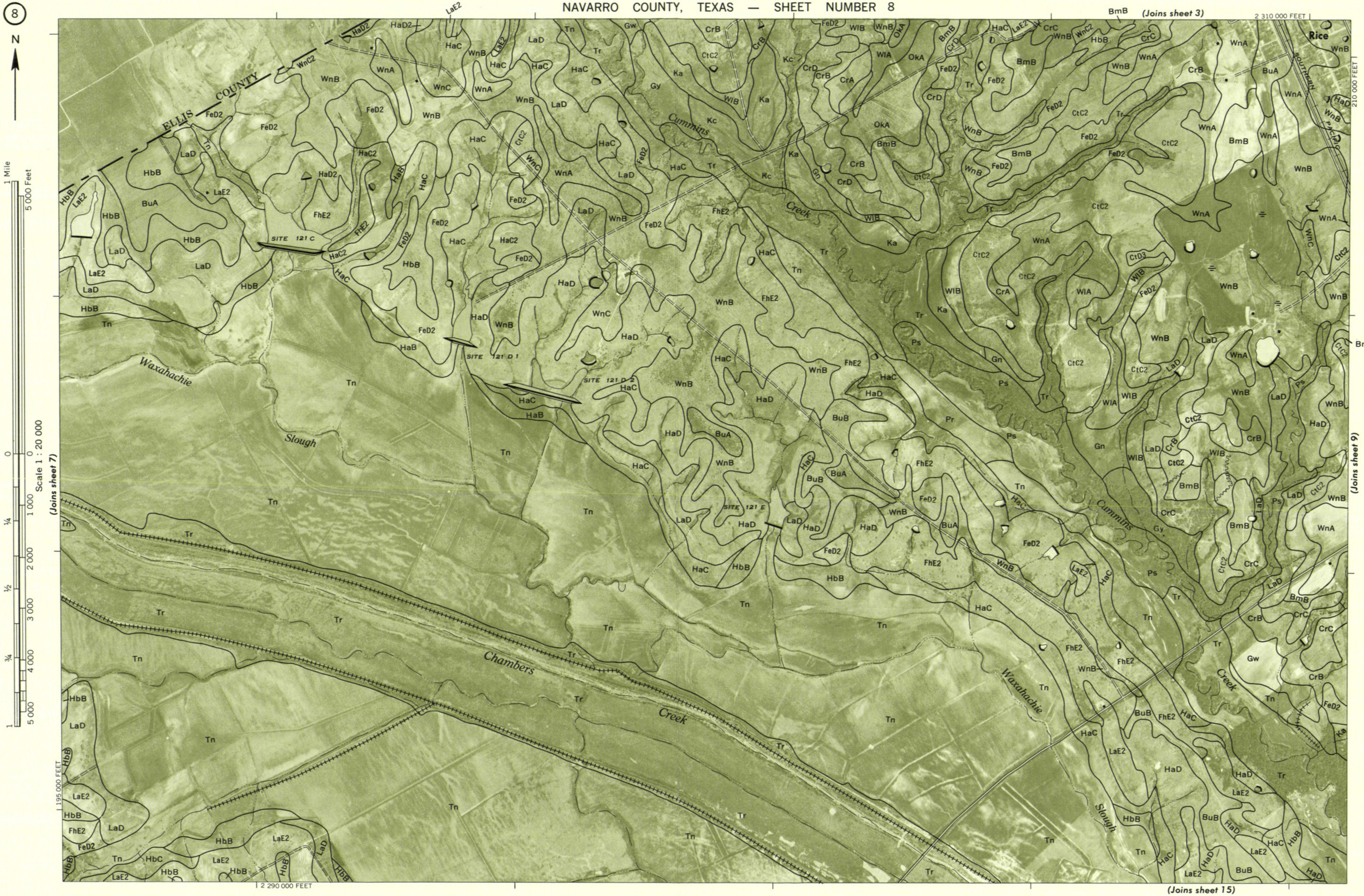
SITE 15

SITE 29

SITE 30

SITE 31

NAVARRO COUNTY, TEXAS — SHEET NUMBER 8



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 8

80

N

(Joins sheet 74)

2 335 000 FEET

75 000 FEET

(Joins sheet 81)

1 Mile

5 000 Feet

Scale 1 : 20 000

(Joins sheet 79)

65 000 FEET

2 315 000 FEET

(Joins sheet 85)

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 80

Little Pin Oak Creek

Mesquite Creek

SOUTHERN PACIFIC

ROCK PIT

Rushing School

INDEFINITE BOUNDARY FREESTONE COUNTY

NAVARRO COUNTY, TEXAS — SHEET NUMBER 81

81

N

2 340 000 FEET

75 000 FEET

(Joins sheet 80)

2 360 000 FEET

65 000 FEET

FREESTONE COUNTY

BOUNDARY

INDEFINITE

Cade Chapel

Creek

Elm

Mesquite

45

1 Mile

5 000 Feet

Scale 1 : 20 000

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS NO. 81

NAVARRO COUNTY, TEXAS — SHEET NUMBER 82

N

1 Mile
5 000 Feet
0 0
Scale 1 : 20 000
¼ 1 000
½ 2 000
3 000
¾ 4 000
1 5 000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

NAVARRO COUNTY, TEXAS — SHEET NUMBER 83

NAVARRO COUNTY, TEXAS NO. 83

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2 265 000 FEET

55 000 FEET

45 000 FEET

2 285 000 FEET

(Joins sheet 82)

(Joins sheet 78)

(Joins sheet 84)

83

N

Scale 1 : 20 000

1 Mile

5 000 Feet

SITE 12

INDEFINITE BOUNDARY

LIMESTONE COUNTY

Alligator Creek

Alligator Cr

Rodney

Pin Oak Creek

WnA WnB WIA WIB CrA CrB CrC CtC2 Kc Ka Tn Tr Pr Gw Pin

84

N

(Joins sheet 79)

(Joins sheet 83)

(Joins sheet 85)

2 310 000 FEET

6 0 000 FEET

45 000 FEET

2 290 000 FEET

1 Mile

5 000 Feet

0 0

Scale 1 : 20 000

1 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾

Creek

Oak

Pin

Cedar

Creek

SITE 26A

SITE 26

INDEFINITE BOUNDARY

LIMESTONE COUNTY

FREESTONE COUNTY

New Wortham Lake

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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NAVARRO COUNTY, TEXAS NO. 84

N

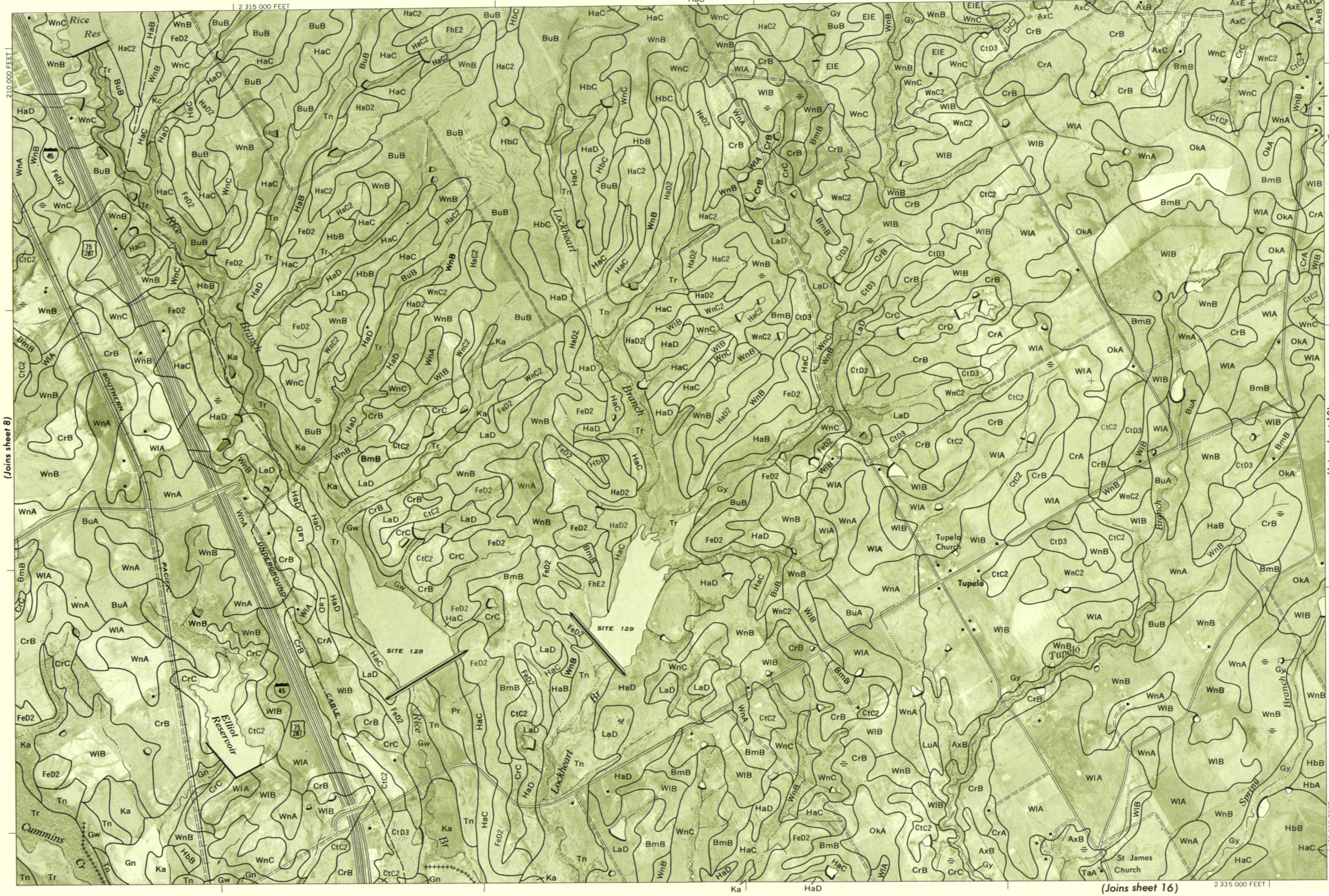
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000
Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 85

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

(Joins sheet 4)



(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 16)

N

1 Mile
5 000 Feet
Scale 1 : 20 000

NAVARRO COUNTY, TEXAS NO. 9

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.
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